

a fireman cannot be depended on to monitor his engineman—even when, as in this case, the result of his inattention will be the loss of his own and the engineman's lives. The only way to insure the vocal calling of signals across the cab at numerous designated places would be to have the oral function supplemented by the operation of some apparatus which should make a permanent record of each instance; and that would not be easy.

It is fundamental that a satisfactory force of reliable men for the delicate responsibilities of track foremen such as is needed on any road running fast trains, cannot be assured except by systematic training, long continued; yet, as everybody knows, the most of our training in that line is unsystematic and far from ideally satisfactory.

These are obvious fundamentals, too little disputed to need demonstration. It is also undisputed that in the operating department most of our railroads are under-officered; or, in more scientific phrase, do not have the right quantity (and quality) of supervision.

The Boston & Maine Re-Organization Complete

ON DECEMBER 1 James H. Hustis was discharged as receiver of the Boston & Maine, and it is understood that Woodward Hudson, who is now president, will soon resign and Mr. Hustis will be elected president.

The Boston & Maine was re-organized under federal supervision and during federal operation of the property. It is the only road that has had its financial affairs re-organized during the two years of government operation of the railroads. The re-organization of the Boston & Maine necessitated the relinquishing of presumably valid legal rights on the part of the holders of stock of six of the eight leased lines—the Fitchburg, the Boston & Lowell, the Connecticut River, the Concord & Montreal, the Lowell & Andover, the Manchester & Lawrence, and the Kennebunk & Kennebunkport. Before the Boston & Maine receivership, of the total 4,370 miles operated but 1,374 were owned and the remainder was leased. The re-organization provides for the direct ownership by the Boston & Maine of 3,315 miles out of the total 4,370 miles operated. Owners of the stock of the leased lines, on which stock the Boston & Maine had guaranteed dividends at varying rates as rental, agreed under the re-organization plan to accept new preferred stock of the Boston & Maine, dollar for dollar for their holdings of leased line stock. Dividends on this new preferred stock, however, are to be 20 per cent less for the first five years than the dividends on the old leased lines stock. The re-organization is to be retroactive to cover the entire year 1919.

The fact that the re-organization took place under federal supervision was probably of help to the re-organization committee in bringing pressure to bear on the holders of leased lines stock, to force them to accept a reduction for five years in their income. The re-organization presents many points of interest. In 1910, the Boston & Maine common stock sold at 152, and as late as 1913 the preferred stock sold at 133. The re-organization of the system did not scale down the outstanding debt or stock, but did reduce the interest and guaranteed dividends, and provided for funding unfunded debt. The total unfunded debt before re-organization was \$88,317,000 and in addition there was \$19,879,000 unfunded debt. The re-organized company has no unfunded debt and \$103,167,000 funded debt. The interest charges and guaranteed dividends before re-organization amounted to \$8,056,000 and now amount to \$4,407,000 interest and \$2,036,000 dividends on the new first preferred stock. It

is hardly likely that under government operation in 1919 the property will have earned the full dividend on the preferred stock in addition to interest charges, but the interest charges will have been shown as safely earned, and the increase in freight rates of 25 per cent on business within New England which the Interstate Commerce Commission has already approved of, but which has not as yet gone into effect, will add nearly \$8,000,000 to the earnings in 1920.

There were many causes contributory to the Boston & Maine receivership. The Massachusetts law permitted the sale of stock only at approximately the market price. Thus when Boston & Maine stock was selling at 130, and new financing had to be done, stock could be offered to stockholders at about 130. Naturally there was no incentive to absorb any considerable new offering of stock, and financing, therefore, could not be done through the sale of stock, notwithstanding the fact that the stock was selling above par. The refunding of a floating debt has now been done, although the prospects of a company like the Boston & Maine doing further financing through the sale of stock depends on the general railroad legislation which is adopted by Congress. Leased line dividends as a fixed charge were a burden on the old company which has now been done away with.

The management of the Boston & Maine prior to the election of Mr. Hustis as president, was sound rather than progressive, and was made more difficult by the relations between the New York, New Haven & Hartford, and the Morgan-Mellen attempt to control the Boston & Maine with the resulting lack of confidence both among officers and employees, and on the part of the general public.

The new company will start operation with a management which has actually been in charge of the property both under receivership and during the period of government control. Long steps have already been taken to bring the details of up-keep, replacement, operating methods, etc., up to modern standards, and the confidence and loyalty of employees and officers and the public has been gained by Mr. Hustis, both during the receivership and in the trying period when he was acting as district director of the New England roads. With a favorable general railroad situation, the Boston & Maine has for the first time in very many years a chance to become a first-class railroad property.

Government Operation Under Mr. Hines

IN A RECENT DISCUSSION of railroad legislation Senator Morris of Nebraska said that those who favored government ownership would be fundamentally opposed to the kind of government control that we have had during the last two years. Senator Cummins of Iowa replied that while he did not think the organization under which the railways have been operated has been ideal, because it has had too much arbitrary power, he believed it has been more competent to operate the railroads than one such as probably would exist under government ownership. He paid especial tribute to Director General Hines, who he believed had operated the railways as economically as was practicable.

Nobody who really knows anything about the railroad business will question that Senator Cummins was right in the position he took. There have been many things to criticize in the way in which government control has been exercised; but the Railroad Administration has never varied from the policy originally adopted by Mr. McAdoo of keeping trained railroad men in almost all the important positions on the railroads; and these men have almost without exception rendered it as energetic and able service as they ever rendered the companies. They "stayed with the ship" largely because the country was at war, however; and it can-

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not be assumed that they would all, or most of them, stay if a policy of permanent government ownership were adopted.

Senator Cummins' complimentary references to the character of the services which have been rendered by Mr. Hines were particularly deserved. Mr. Hines became and has served as director general under especially unfavorable conditions. The war was over when he became director general, and therefore the spirit which the war had infused into railway officers, employees and patrons was on the wane. The freight traffic and earnings of the railways were rapidly declining. Labor, in spite of these facts, was beginning to ask again for large advances in wages, and to threaten to tie up the railroads if they were not granted. The Railroad Administration was in sore need of funds to meet its obligations to the railroad companies and to carry out an improvement program, and yet about two months after Mr. Hines became director general the railroad appropriation bill was defeated by a filibuster, and subsequently, when Mr. Hines asked for a larger appropriation than he had sought at first, Congress gave him only part of what he asked for.

In May President Wilson announced that the railways would be returned to private operation, and before and since then some of the ablest men in the Railroad Administration have left it to return to the corporations with which they were formerly connected. To cap the climax, just as the railroads had begun to handle a large freight traffic again and to earn enough monthly to pay the government's guarantees to the companies, the coal strike came, with its inevitably very bad effects upon railroad expenses and earnings. In spite of these and other difficulties, the Railroad Administration has come through the year much better than seemed at all probable when Mr. Hines became director general. It has succeeded in avoiding a general railroad strike while at the same time refusing to grant employees the large increases in wages which they demanded. It has bridged over the financial chasm which yawned beneath it when the railroad appropriation bill failed. It has restored operating efficiency to something near normal and has rendered about as good service as was practicable with the facilities available. It has kept the deficit smaller than seemed possible six months ago.

While all the railway officers who served the government deserve credit for the way in which the railways have been operated in 1919, the chief credit belongs to Mr. Hines. He has made mistakes, and has received criticism from many sources, but we believe that most persons competent to judge will agree that in handling the situation he has shown rare courage, fairness, resourcefulness and ability. It is difficult to conceive how, in the circumstances, he could have done better in most respects than he has.

Senator Cummins is entirely right in saying that under government control the railways have been better managed than they would be under government ownership. The very autocratic power possessed by the director general which he regards as objectionable has been one of the principal reasons why they have been as well managed as they have been. If the director general had not had autocratic power he would have been subjected to more political interference. If there had been serious political interference it is inconceivable that men such as Mr. Hines and the other important railroad men in the Railroad Administration would have stayed in it. If they had not stayed the efficiency of railroad operation, instead of having increased as it has since Mr. Hines took charge, would have decreased. Those who say that the results of government control are no measure of the results which would be secured under government ownership and operation are right. The results under permanent government ownership and operation undoubtedly would be very much worse.

Letters to the Editor

Politeness and Intelligence Combined

NEW YORK CITY.

TO THE EDITOR:

In discussing the Dunkirk collision (issue of October 31) you refer to the ideal trainmaster and the joys and sorrows connected with his difficult task. We all sympathize with him, for his problems every day are as puzzling as the puzzles to which you refer as afflicting the investigator of collisions—who at least has a little rest between collisions.

But whatever may be the obstacles to becoming an ideal trainmaster, the traveling public demands that such obstacles be overcome, for it is the trainmaster that keeps trains running; without him and his principal aide, the chief despatcher, the wheels would stop. I wish to cite an illustrative incident. A certain New York paper says: "Most of those who got off the 5 o'clock train yesterday at M— emerged from a car whose door was opened by a passenger. There was no trainman at hand, and when the trainman's attention was called to the fact that there was nobody to open the door he said, 'Go ahead and report it. We can't be everywhere at once.'"

That brakeman gave a reply which was all right in substance but all wrong in style. According to the letter and spirit of the instructions which are usually given to passenger trainmen on the best roads, this man should have said, "I regret that you have been inconvenienced, but I have no authority to improve the situation, and if you are seriously aggrieved I shall have to refer you to the passenger traffic manager. He, no doubt, will adjust the matter to your satisfaction; at least he has done so on all previous occasions of this kind, so far as I can recall. The trouble, you see, is that we are shorthanded." To this train of eight cars only two trainmen are assigned, and as one of these must remain at the rear end to flag or to be prepared to flag (our block signal system, costing \$3,000 a mile, being slightly unreliable at times), I alone am left to attend to the vestibule doors of four or five cars. Usually I get around so as to open them all before we reach the station platforms, but today I am delayed because one of the doors stuck and caused me a lot of trouble. I assure you that we are doing about as well as you have a right to expect: You (through the cheap character of the men you send to the legislature) have forced the railroads to spend millions of dollars too much in hiring men to man their freight trains, and now you see they are spending millions too little on passenger train crews."

Now, in all seriousness, is not that about the course of reasoning which the brakeman is expected to employ? If employees who come in contact with passengers are to be really polite in their conduct habitually, and without straining or worrying, they must do their own thinking, and if they think these things they are pretty likely to express some of them. One of the trainmaster's big tasks is to educate the brakeman (and conductors and ticket sellers as well) to put the best foot forward; to "speak a good word for the company," even when to do so he must put a prodigious pressure on his feelings in order to avoid exposing the unpleasant things which he thinks about his employer. How can this be done? Readers of the *Railway Age* would like to hear from any trainmaster who has succeeded in educating his brakemen to carry out his best theories in this matter.

This letter may seem like a pretty stiff attack on the train-

master, but it is not; it is intended mainly for his superiors. Will you not call on a dozen or so of your friends among the superintendents to explain why they do not strengthen their trainmasters? They do not educate, do not encourage, do not fully pay the better men among their trainmasters, and they are not severe enough in getting rid of the poorer ones. These superintendents are in duty bound to defend themselves, if any defense is possible. Some superintendents need a lot more boldness when they face the general manager. It is the duty of superintendents—all of them combined—to force him to make such appropriations as are necessary to elevate the character of the trainmasters generally.

In his immediate staff the general manager aims to employ men in whom politeness and intelligence are combined; in the train service he falls very far below 100 per cent in this respect; and yet he tells the public that 100 per cent is what he is aiming at. This is a feature of his work in which many a general manager has the reputation of being a very poor marksman.

J. E. J.

A Woman Stockholder on Railroad Legislation

DENVER, COL.

TO THE EDITOR:

As a small holder of railway securities, I am very greatly perturbed by the recent action of the House of Representatives in cutting out from the proposed railway bill, as reported by its committee, that provision establishing a definite formula for the guidance of the Interstate Commerce Commission in fixing a basis for rates.

According to my understanding, the House bill as now amended would leave the whole matter of railway rates and revenue to the discretion of the Interstate Commerce Commission, and that without any definite expression from Congress itself as to what such rates should be.

There are thousands of women (in one of my companies there are 11,000 women stockholders) who, like myself, are small holders of railway securities, either left to them, or bought by them for cash, at different times as a permanent investment. It seems to me that Congress having resumed the responsibility of regulating the railways, should also assume that of outlining a definite policy for the guidance of the Interstate Commerce Commission.

In this regard, I feel that the Cummins bill is far more satisfactory than even the House bill as reported by its committee and that when the matter is taken up as I suppose it will be by a conference committee of both houses, I hope that Section 6 of the Cummins bill will be accepted.

While it seems to me that even the Cummins bill has dealt niggardly with the situation, it will surely be better to have a definite law based on Section 6 of the present Cummins bill, than to leave the whole matter in the indefinite shape in which it has been heretofore.

As I understand it, Section 6 recommends a minimum return of 6 per cent. to investors. This I think is fair. Unless this can be brought about, so as to relieve our terrible uncertainty, I know that many will be compelled to dispose of their holdings.

As strongly as I can, I wish to urge in the interests of small investors, like myself, that Congress recognize and assume the responsibility resting upon it, of giving to its agent, the Interstate Commerce Commission, definite instructions regarding the future treatment of the railroads. Unless Congress itself is willing to determine and announce such a policy, I shall feel strongly inclined to dispose of my railway holdings even at a loss, due to present low prices and invest

in some other enterprise that has not yet been brought under the definite control of Congress.

Regarding any of the other features in either of the bills now before Congress, I do not express an opinion, because I do not feel that I am sufficiently acquainted with the subject to justify me in doing so. I am, however, deeply interested in the solvency of our American railroads, and it seems to me, that this is a matter wholly dependent upon an adequate basis of rates and depending entirely upon either the action of Congress itself or its agent, the Interstate Commerce Commission.

(MRS.) ANNA C. TOLMAN.

Information About Profit Sharing

No. 1 Madison Avenue,
NEW YORK CITY.

TO THE EDITOR:

"Profit Sharing by American Employers," the report of an investigation of profit sharing between employer and employee, which was published by the National Civic Federation in 1916, is greatly in demand and is to be reissued with certain amplifications. To make it as comprehensive as possible, information is desired from all employers concerning the six different plans, namely: 1, percentage of profits; 2, special distributions; 3, stock ownership plans; 4, exceptional plans; 5, abandoned plans; 6, proposed plans. Any concern which uses any form of profit sharing is requested to give date of installation; and, if not in force when discontinued, and why; average number of employees at this time and how many participate in the plan; state of feeling toward the plan by those for whose benefit it was intended; whether the plan has been the means of modifying the tendency toward labor troubles; whether limited to heads of departments; and whether an unqualified success, or if not, where it has failed. Information marked confidential will be so treated.

GEORGE W. PERKINS.

Chairman Profit Sharing Department, National Civic Federation.



The Trans-Andine Railway Operating Under Difficulties

The Canadian Pacific Builds Refrigerator Cars

Equipped with Tank Bunkers, Meat Racks and Ventilators; Steel Underframe Construction, 41 ft. Long

THE CANADIAN PACIFIC has recently built at its Angus shops, Montreal, an order of steel underframe refrigerator cars, which embody a number of interesting features, both in the underframe and body construction as well as in the refrigerating equipment.

These cars are 41 ft. long, and have an average tare weight of 59,000 lb. to 60,000 lb. They are carried on 40-ton trucks, which gives them a load limit capacity, including ice, of 72,000 lb. to 73,000 lb. They are designed for satisfactory service when handling any of the several different commodities which require transportation in insulated cars because of the need of protection from heat or frost, and also for other miscellaneous freight which may properly be loaded in refrigerator cars when they are not required for the transportation of perishables.

As packing house products are regularly handled in Can-

plate slides which are secured in a closed position at all times except when the cars are operating under ventilation.

The use of ice or ice and salt when operating under ventilation, is optional, thus providing a wide range of regulation which may be varied to suit the seasons, conditions of the load, and the distance to be moved. Fruit fresh from the field is a very difficult commodity to transport, as the field heat and heat generated by the ripening process produces a condition that is difficult to handle. However, the brine tank ventilator car when equipped with suitable floor racks arranged so that free circulation will take place around the ice and out under the racks, is particularly suited to this traffic, as the use of salt on the initial icing lowers the temperature of the car rapidly, absorbing the field heat and checking the process of ripening. For fruit shipments it is well to apply temporary slats along the sides of the car to provide space



Steel Underframe Refrigerator Car with Brine Tanks and Ventilators, for the Canadian Pacific

ada by railroad owned refrigerators, these cars are equipped with galvanized iron tank bunkers which permits the use of salt as required to obtain the proper degree of temperature. To prevent the exchange of air through the hatch openings at any time and especially when the hatches are opened for re-icing, the tanks fit well around the ceiling. Regulation meat racks are included as part of the roof and ceiling construction.

For berry and fruit traffic it is necessary to provide a means of ventilation. This has been taken care of by providing openings in the fronts of the ice tanks near the top, so that when the hatch covers and plugs are opened, air will circulate freely into and through the car. The ventilator openings are fitted with malleable iron frames and close fitting

for circulation at the sides as well as underneath. All other perishables may easily be transported safely in these cars, provided reasonable care is used in loading so that the air within the car may circulate freely.

Whenever the lading requires protection from frost, charcoal heaters are placed in the corner ice tanks, two or more per car as required.

The Refrigerating Equipment

Permanent floor racks made of 1 $\frac{3}{4}$ -in. by 3 $\frac{3}{4}$ -in. fir are installed in sections, five sections on each side of the car. They are secured with hinges, similar to those used on side doors, to the lining base plank and when propped up against the car sides, the racks are entirely clear of the floor, thus

permitting the floor to be thoroughly and easily cleaned and swept out through the side door openings. The racks are made of relatively heavy material to insure durability, especially when the car is loaded with miscellaneous merchandise freight.

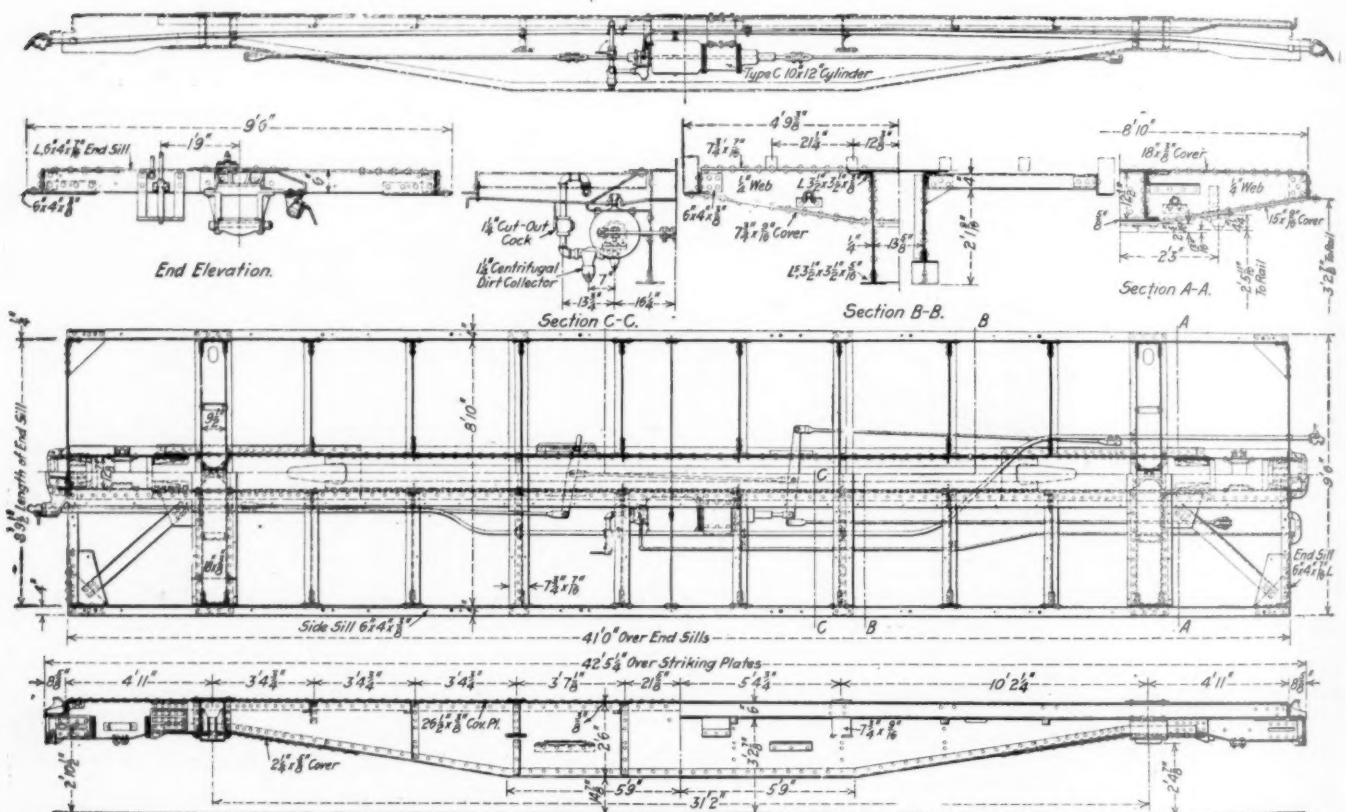
The ice bunkers consist of four rectangular galvanized iron tanks at each end of the car; the tank bottoms are $\frac{1}{8}$ -in. pressed steel, galvanized after pressing, and the sides are 16-gage galvanized iron. Substantial lugs are riveted near the top. These lugs bear against the underside of the hatch frame and prevent the tanks from jumping when the cars are being switched. The tank supports consist of angle irons which are arranged so that the front supporting angle may be removed without disturbing any tank. After the removal of this angle one or more tanks may be removed and re-applied without disturbing the others.

The drip pan under the tank is sloped from the rear end

Insulation

The floor insulation consists of one layer of 90-lb. waterproof insulation paper applied in one piece from side to side and end to end of the car, thereby covering the entire under-frame and sub-floor. On top of this are placed the floor stringers. The center stringers rest on and are bolted to the edge of the center sill cover plate, while the intermediate stringers rest on and are bolted to the bolsters, crossbars and floor beams. Between the stringers four layers of $\frac{1}{2}$ -in. insulation are applied in strips, continuous from end to end of the car. Each layer consists of hair or fibre felt between two courses of 90-lb. waterproof insulation paper. The four layers are applied in two courses of double layers with nailing strips and $\frac{3}{8}$ -in. tongued and grooved boards between.

The floor consists of two courses of tongued and grooved boards, the under course $\frac{5}{8}$ in. thick, over which is spread a heavy coating of felt, waterproof asphalt, and over this



Steel Underframe for the Canadian Pacific 41-ft. Refrigerator Cars

towards the front of the tank, so as to be as nearly self-clearing as possible. The front edge of the drip pan is made of $\frac{1}{8}$ -in. pressed steel plate, galvanized. This arrangement avoids, to a considerable degree, the obstruction of free circulation of air down around the tanks and out under the floor racks.

Only the center tanks at the ladder corners are equipped with a drain valve. The remaining three tanks at each end of the car are coupled to this tank by hose connections located two feet above the tank bottom. The drain valve is connected to a pipe extending directly through the car floor.

Insulated bulkheads are provided in front of the ice bunkers. These bulkheads are hinged at one side of the car so that they may easily be swung open for inspection, cleaning or repairing the tanks. These bulkheads have an extension at the bottom with horizontal slats to prevent small crates or boxes from sliding under the bulkhead.

The ice hatches are of U. S. R. A. design, modified only as absolutely necessary to suit conditions.

one layer of two-ply asphaltum roofing paper. The top course boards are $1\frac{1}{8}$ in. thick.

The side and end walls are insulated with three layers of $\frac{1}{2}$ -in. insulating material, each layer stitched between two layers of 90-lb. waterproof insulation paper. Side and end wall insulation extends continuously from floor to ceiling and from the door opening to the end of the car, across the end and to the door post opposite the starting point. One layer of the insulation is applied on the outside of the superstructure frame, overlapping and fastened to the sills and plates. Two courses are applied on the inside of the framing, against the $\frac{3}{8}$ -in. tongued and grooved sheathing. The outside sheathing consists of standard 13/16-in. tongued and grooved car sheathing and the inside lining is 13/16-in. tongued and grooved basswood or spruce. The total thickness through the side walls is $6\frac{1}{2}$ in.

The roof insulation consists of six layers of $\frac{1}{2}$ -in. insulating material, each layer stitched between two courses of 90-lb. waterproof insulation paper. The insulation is applied in

one piece between the carlines from side plate to side plate. It is applied in three double layers, each double layer supported on $\frac{3}{8}$ -in. tongued and grooved boards.

On the top side of the ceiling boards one layer of 90-lb. waterproof insulation paper is applied in one piece from side to side and end to end of the car.

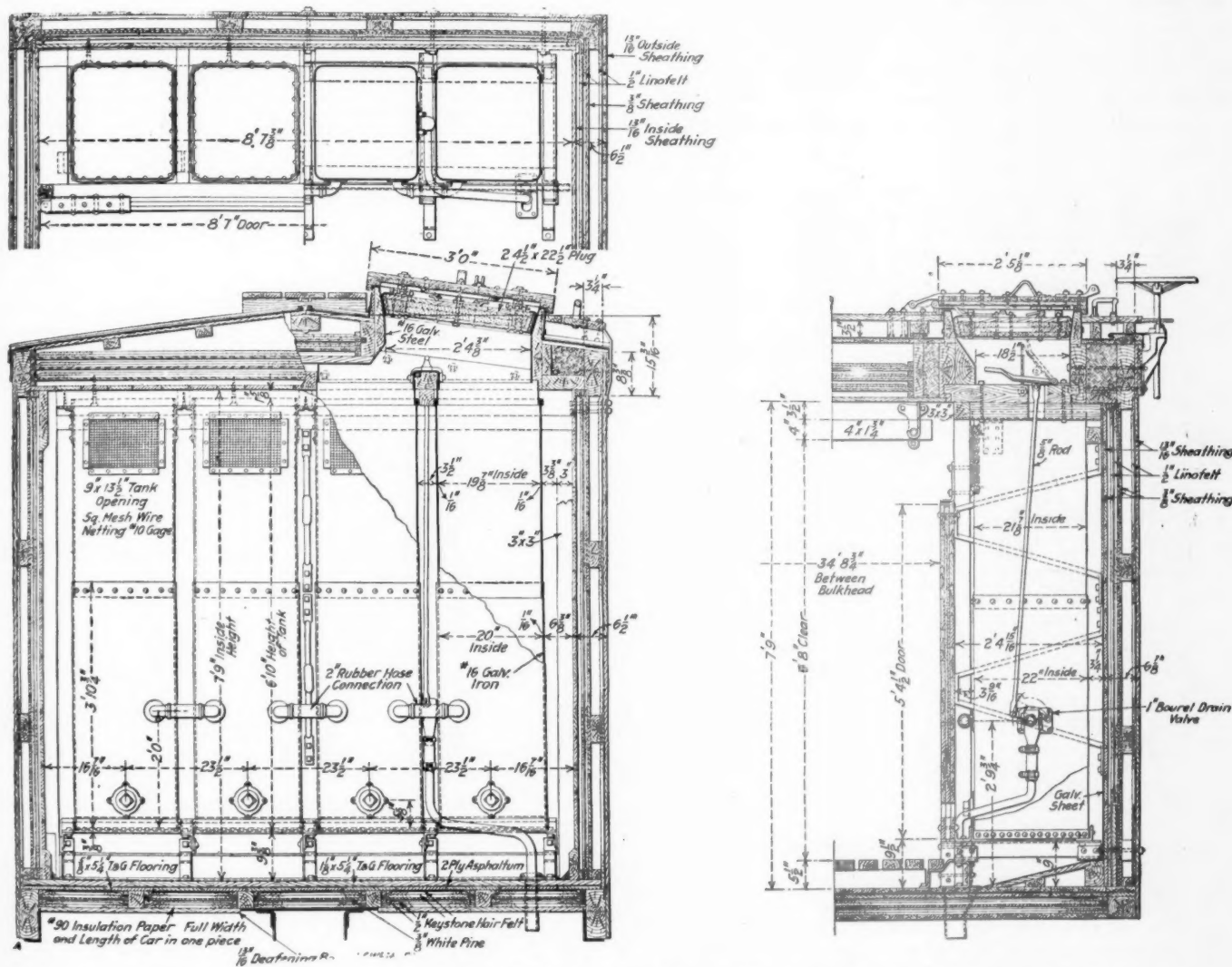
Superstructure Frame

The principal framing members of the car body are fir, excepting end sills, end posts and end braces, which are of oak or maple. All of the posts and braces are set in cast iron pockets with the exception of the end post and braces, which are set in special cast steel pockets each having a high flange on the outside to prevent the lower ends of the posts and braces from springing over the top of the casting. Each

that the roof frame may be assembled on the shop floor and then placed on edge, while the ceiling boards are applied. This enables the builders to work at all times to the best possible advantage, with the result that good work is rapidly done.

The roof is galvanized iron, type XLA, flexible, applied over a single course of boards and one layer of two-ply asphaltum roof paper. As already noted, the spacing of the carlines is governed by the spacing of the meat rack supports and on account of the roof insulation the roof mullions and running board saddles are spaced to coincide with the carline centers; this provides a solid construction for nailing the mullions.

The roof sheet pivot saddles are secured by carriage bolts applied through a special washer nailed on the underside of



Arrangement of the Brine Tanks and Body Construction Details of the C. P. R. Refrigerator Cars

casting is bolted directly through the steel end sill flange with two $\frac{5}{8}$ -in. bolts. This is to prevent the pocket from tipping out and also to avoid trouble caused by dowels splitting the wood end sill.

Diagonal brace rods are employed at each side frame panel to reduce racking to a minimum.

The spacing of the carlines coincides with the spacing of the meat rack cross supports and the supporting bolts pass through the carlines, thus avoiding longitudinal blocking which is undesirable, particularly on account of interference with insulation. At alternate carlines $\frac{3}{4}$ -in. cross tie rods are applied.

The framing and insulation of this car are so arranged

the ridge pole; this washer when applied is L-shaped and is secured by two nails. After the carriage bolt has been applied the projecting end of the washer is bent back under the bolt head so as to prevent the bolt from dropping down. The hole in the washer is square to suit the shank in the bolt head.

The side doors are equipped with W. H. Miner fasteners. The threshold plates are of pressed steel with a shallow shoulder at the inside edge for the stripping on the lower inside edge of the door to close against. The open door fastener consists of a link and bolt arrangement that cannot become unfastened accidentally.

Side door thresholds and all metal work on the interior of

Steam Railroad Statistics to December 31, 1918

Summaries of Reports of Class 1 Corporations and of Federal Operations as Compiled by I. C. C.

THE INTERSTATE COMMERCE COMMISSION has issued tables giving summary of the annual reports of Class 1 steam roads for the calendar year 1918, prepared for use in the Preliminary Abstract of Statistics of Common Carriers, the appearance of which has been greatly delayed due to unusual delay on the part of carriers in filing their annual reports for 1918.

The summary covers only Class 1 roads, excluding switching and terminal companies, and is in three parts:

1. Summary of the reports of the Class 1 corporations, whose property was operated by the United States Railroad Administration.
2. Summary of the reports of federal operations, Class 1 roads.

SUMMARY NO. 1.—GENERAL BALANCE SHEET, INCOME ACCOUNT, PROFIT AND LOSS ACCOUNT, OPERATING REVENUES, OPERATING EXPENSES, AND MILEAGE; FROM THE CORPORATE REPORTS OF CLASS I ROADS, THE PROPERTY OF WHICH WAS OPERATED BY THE UNITED STATES RAILROAD ADMINISTRATION FOR THE YEAR ENDED DECEMBER 31, 1918

No.	Item	Total all districts	Eastern district, Corporate	Southern district, Corporate	Western district, Corporate
ROAD					
1.	Average number of miles of road operated, 1918.....	.....	.....	.....	.....
2.	Average number of miles of road operated, 1917.....	227,403.62	55,961.05	43,025.76	128,416.81
3.	Number of miles of road owned on December 31, 1918.....	178,047.84	35,807.61	35,308.24	106,931.99
4.	Number of miles of road owned on December 31, 1917.....	177,754.99	35,733.97	35,069.73	106,951.29
GENERAL BALANCE SHEET					
5.	Investment in road and equipment.....	\$14,697,277.741	\$5,118,721,139	\$2,548,001,522	\$7,030,555,080
6.	Improvements on leased railway property.....	269,966,452	220,461,734	35,687,985	13,816,733
7.	Investments in affiliated companies.....	3,761,463,367	1,506,019,698	401,352,380	1,854,091,289
8.	Other investments.....	975,925,019	468,717,734	92,289,488	414,917,797
9.	Cash.....	95,483,332	33,596,004	10,543,616	51,343,712
10.	Material and supplies.....	5,558,129	3,871,834	*	1,686,302
11.	Other current assets.....	762,629,299	295,129,524	127,632,019	339,867,756
12.	Deferred assets { U. S. or Company.....	1,608,478,374	748,597,448	260,939,362	598,941,564
13.	Unadjusted debits { Other.....	128,737,477	50,537,532	29,414,856	48,785,089
14.	Total.....	250,007,961	66,534,996	31,870,879	151,602,086
15.	Total stock.....	22,555,527,151	8,512,187,643	3,537,732,100	10,505,607,408
16.	Governmental grants.....	7,124,019,210	2,612,313,620	1,029,636,400	3,482,069,190
17.	Total long-term debt.....	350,414	120,742	128,897	100,775
18.	Current liabilities.....	9,166,838,894	3,243,082,759	1,522,161,689	4,401,594,446
19.	Deferred liabilities { U. S. or Company.....	1,018,101,900	533,349,877	124,225,492	360,526,531
20.	Accrued depreciation.....	1,347,434,012	579,793,155	222,692,276	544,948,581
21.	Other unadjusted credits.....	122,787,696	57,462,724	19,129,165	46,195,807
22.	Additions to property through income and surplus.....	743,825,228	306,145,457	154,519,229	283,160,542
23.	Funded debt retired through income and surplus.....	391,355,448	159,011,290	61,157,356	171,186,802
24.	Sinking fund reserves.....	810,991,075	477,424,787	95,388,452	238,177,836
25.	Miscellaneous fund reserves.....	50,026,068	19,523,475	291,109	30,211,484
26.	Appropriated surplus not specifically invested.....	65,599,237	20,932,809	2,869,335	41,797,093
27.	Profit and loss—credit balance.....	47,711,734	38,809,397	99,461	8,802,876
		114,577,864	8,064,318	3,746,373	102,767,173
		1,551,908,371	456,153,233	301,686,866	794,068,272
INCOME ACCOUNT FOR THE YEAR					
28.	Railway operating revenues.....	746,784	166,989	377,193	202,602
29.	Railway operating expenses.....	9,986,779	3,287,149	951,153	5,748,477
30.	Net revenue from railway operations.....	*9,239,995	*3,120,160	*573,960	*5,545,875
31.	Railway tax accruals.....	37,341,921	12,992,833	6,528,959	17,820,129
32.	Uncollectible railway revenues.....	3,028	2,821	6	201
33.	Railway operating income.....	*46,584,944	*16,115,814	*7,102,925	*23,366,205
34.	Revenues from miscellaneous operations.....	60,482,011	39,924,517	.....	20,557,494
35.	Expenses of miscellaneous operations.....	50,243,480	34,303,018	.....	15,940,462
36.	Net revenue from miscellaneous operations.....	10,238,531	5,621,499	.....	4,617,032
37.	Taxes on miscellaneous operating property.....	2,247,988	1,998,662	.....	249,326
38.	Miscellaneous operating income.....	7,990,543	3,622,837	.....	4,367,706
39.	Total operating income.....	*38,594,401	*12,492,977	*7,102,925	*18,998,499
40.	Hire of freight cars—credit balance.....	228,290	.....	227,858	432
41.	Rent from locomotives.....	.....	.....	.....	.....
42.	Rent from other equipment.....	6,420	.....	6,420	.....
43.	Joint facility rent income.....	.....	.....	.....	.....
44.	Income from lease of road.....	890,632,748	356,183,468	137,509,993	396,939,287
45.	Miscellaneous rent income.....	11,163,492	6,178,482	1,368,271	3,616,739
46.	Miscellaneous non-operating physical property.....	3,521,241	1,622,053	606,203	1,292,985
47.	Separately operated properties—profit.....	2,201,074	1,871,140	.....	329,934
48.	Dividend income.....	91,229,249	37,444,601	8,237,382	45,547,266
49.	Income from funded securities.....	46,417,477	6,963,279	7,561,235	31,892,963
50.	Income from unfunded securities and accounts.....	19,433,754	12,268,209	2,127,856	5,037,689
50½.	Miscellaneous income.....	15,977,891	2,947,031	2,785,347	10,245,513
51.	All other non-operating income.....	5,463,493	4,610,817	172,526	680,150
52.	Total non-operating income.....	1,086,275,129	430,089,080	160,603,091	495,582,958
53.	Gross income.....	1,047,680,728	417,596,103	153,500,166	476,584,459
54.	Hire of freight cars—debit balance.....	814,052	806,639	.....	7,413
55.	Rent for locomotives.....	208,455	208,455	.....	.....
56.	Rent for other equipment.....	107,966	98,311	9,655	.....
57.	Joint facility rents.....	8,421	8,423	*	.....
58.	Rent for leased roads.....	126,637,099	73,166,107	7,887,567	45,583,425
59.	Miscellaneous rents.....	5,137,891	3,477,824	339,530	1,320,537
60.	Miscellaneous tax accruals.....	2,528,045	1,348,335	56,834	1,122,876
61.	Separately operated properties—loss.....	3,328,820	2,922,869	6,820	399,131
62.	Interest on funded debt.....	392,261,972	139,118,561	70,499,142	182,644,269
63.	Interest on unfunded debt.....	28,846,922	18,126,940	1,548,404	9,171,578
63½.	Miscellaneous income charges.....	84,453,837	36,821,684	8,331,569	39,300,584
64.	All other income deductions.....	3,811,396	1,846,330	413,408	1,551,658
65.	Total deductions from gross income.....	648,144,876	277,950,478	89,092,927	281,101,471
66.	Net income.....	399,535,852	139,645,625	64,407,239	195,482,988
67.	Income applied to sinking and other reserve funds.....	8,735,897	5,582,988	428,863	2,724,046
68.	Dividend appropriations of income.....	212,347,007	71,400,296	6,130,866	134,815,845
69.	Income appropriated for investment in physical property.....	27,437,682	9,113,229	819,997	17,504,456
70.	Stock discount extinguished through income.....	.....	.....	.....	.....
71.	Miscellaneous appropriations of income.....	486,019	386,894	85,631	13,494
72.	Total appropriations of income.....	249,006,605	86,483,407	7,465,357	155,057,841
73.	Income balance transferred to profit and loss.....	150,529,247	53,162,218	56,941,882	40,425,147

*Represents deficit, loss, or other reverse item.

No.	Item	Total all districts	Eastern district, Corporate	Southern district, Corporate	Western district, Corporate
PROFIT AND LOSS ACCOUNT					
1.	Credit balance transferred from income.....	\$152,292,646	\$54,925,617	\$56,941,882	\$40,425,147
2.	Profit on road and equipment sold.....	764,423	226,828	156,931	380,664
3.	Delayed income credits.....	2,511,660	222,096	1,049,863	1,239,701
4.	Unrefundable overcharges.....	793,316	253,481	21,404	518,431
5.	Donations.....	1,140,366	264,097	306,442	569,827
6.	Miscellaneous credits.....	37,246,956	8,924,570	16,876,570	11,445,816
7.	Total credits during year.....	194,749,367	64,816,689	75,353,092	54,579,586
8.	Surplus applied to sinking and other reserve funds.....	2,053,889	1,678,599	169,415	205,875
9.	Dividend appropriations of surplus.....	61,090,543	24,823,532	31,944,462	4,322,549
10.	Surplus appropriated for investment in physical property.....	14,000,486	883,657	10,084,007	3,032,822
11.	Stock discount extinguished through surplus.....	4,310,837	1,073,830	994,707	2,242,300
12.	Debt discount extinguished through surplus.....	1,142,120	290,290	851,830	.....
13.	Miscellaneous appropriations of surplus.....	6,734,083	1,513,788	337,122	4,883,173
14.	Loss on retired road and equipment.....	7,220,302	5,231,411	1,851,099	137,792
15.	Delayed income debits.....	44,060,905	15,248,457	15,375,357	13,437,091
16.	Miscellaneous debits.....	140,583,165	50,743,564	61,607,999	28,231,602
17.	Total debits during year.....	54,166,202	14,073,125	13,745,093	26,347,984
18.	Net increase during year.....	1,497,742,170	442,080,108	287,941,774	767,720,288
19.	Balance at beginning of year.....	1,551,908,372	456,153,233	301,686,867	794,068,272
20.	Balance at close of year.....	.....	.....	.....	.....
RAILWAY OPERATING REVENUES					
21.	Freight.....	\$50,276	\$50,345	*1	70
22.	Passenger.....	598,017	223,256	374,926	*165
23.	Excess baggage.....	2,142	*1	2,143	.....
24.	Sleeping car.....	.....	.....	.....	.....
25.	Parlor and chair car.....	*5	*5	.....	.....
26.	Mail.....	154	154	.....	.....
27.	Express.....	202,263	*381	.....	202,644
28.	Other passenger-train.....	.....	.....	.....	.....
29.	Milk.....	76	.....	76	.....
30.	Switching.....	*4,855	*4,855	.....	.....
31.	All other rail-line revenue.....	747,516	167,823	377,144	202,549
32.	Total rail-line transportation revenue.....	.....	.....	.....	.....
33.	Total water-line transportation revenue.....	.....	.....	.....	.....
34.	Total incidental operating revenue.....	*1,082	*1,184	49	53
35.	Joint facility—Cr.....	352	352	.....	.....
36.	Joint facility—Dr.....	1	1	.....	.....
37.	Total railway operating revenues.....	746,785	166,990	377,193	202,602
RAILWAY OPERATING EXPENSES					
38.	Total maintenance of way and structures.....	203,679	123,148	1,028	79,503
39.	Total maintenance of equipment.....	2,323,398	74,487	20,665	2,228,246
40.	Total traffic.....	93,156	124	8,113	84,919
41.	Total transportation—rail line.....	313,076	269,639	40,415	3,022
42.	Total transportation—water line.....	.....	.....	.....	.....
43.	Total miscellaneous operations.....	1,465	1,163	.....	302
44.	Total general expenses.....	7,052,109	2,818,692	880,932	3,352,485
45.	Transportation for investment—Cr.....	103	103	.....	.....
46.	Grand total railway operating expenses.....	9,986,780	3,287,150	951,153	5,748,477

*Represents deficit, loss or other reverse item.

3. Summary of the reports of Class 1 roads not under federal control.

The income from lease of road received by the corporations under federal control is shown as \$890,632,748. This includes the rental from the United States government so far as accrued by the corporations on their books.

The profit and loss credit balance of the Class 1 corporations, including those not under federal control, at the close

of the year 1918 was \$1,536,805,230, as compared with a corresponding amount of \$1,473,359,933 shown in the Preliminary Abstract for 1917.

The dividends declared from income and surplus in 1918 by these Class 1 corporations amounted to \$275,375,300 as against \$321,055,780 for 1917. The net income of Class 1 corporations amounted to \$398,659,958 as against \$589,044,923 in 1917.

SUMMARY No. 2.—GENERAL BALANCE SHEET, INCOME ACCOUNT, PROFIT AND LOSS ACCOUNT, OPERATING REVENUES, OPERATING EXPENSES, MILEAGE, EQUIPMENT AND CERTAIN STATISTICS OF RAIL-LINE OPERATIONS; FROM REPORTS OF OPERATIONS OF CLASS I ROADS BY THE UNITED STATES RAILROAD ADMINISTRATION, FOR THE YEAR ENDED DECEMBER 31, 1918

No.	Item	Totals, all districts	Eastern district, Federal	Southern district, Federal	Western district, Federal
ROAD					
1.	Average number of miles of road operated, 1918.....	230,422.19	58,639.30	43,124.30	128,658.59
GENERAL BALANCE SHEET					
7.	Investments in affiliated companies.....	\$1,388,816	\$5,515	\$140,900	\$1,242,401
8.	Other investments.....	27,354,578	4,466,819	6,860,615	16,027,144
9.	Cash.....	207,100,510	99,132,105	32,953,790	75,014,615
10.	Material and supplies.....	621,712,766	273,890,851	95,688,738	252,133,177
11.	Other current assets.....	640,029,821	298,930,292	119,911,316	221,188,213
12.	Deferred assets { U. S. or company.....	1,370,840,494	607,286,690	245,146,095	518,407,709
13.	Unadjusted debits { Other.....	47,986,982	15,544,762	5,769,070	26,673,150
14.	Total.....	450,587,482	181,338,864	65,503,607	203,745,011
17.	Total long-term debt.....	3,367,001,449	1,480,595,898	571,974,131	1,314,431,420
18.	Current liabilities { U. S. or company.....	1,635,445	519,526	.....	1,115,919
19.	Deferred liabilities { Other.....	735,014,739	338,297,184	118,215,970	278,501,585
20.	Accrued depreciation.....	1,389,112,852	661,354,383	223,696,305	503,562,164
21.	Other unadjusted credits.....	44,414,811	10,210,464	8,815,706	25,388,641
22.	Additions to property through income and surplus.....	109,491,009	48,044,204	23,039,547	38,407,258
27.	Profit and loss—credit balance.....	331,407,779	182,516,832	45,183,104	103,707,843
INCOME ACCOUNT FOR THE YEAR					
28.	Railway operating revenues.....	755,924,744	239,153,305	153,023,429	363,748,010
29.	Railway operating expenses.....	4,850,991,013	2,201,716,136	784,431,573	1,864,843,304
30.	Net revenue from railway operations.....	3,948,132,199	1,883,841,833	609,124,537	1,455,165,829
31.	Railway tax accruals.....	902,858,814	317,874,303	175,307,036	409,677,475
32.	Uncollectible railway revenues.....	183,798,845	72,726,127	27,669,099	83,403,619
33.	Revenues from miscellaneous operations.....	601,662	174,778	.....	300,106
34.	Expenses of miscellaneous operations.....	718,458,307	244,973,398	147,511,159	325,973,750
35.	Net revenue from miscellaneous operations.....	1,111,209	.....	722,345	388,864
36.	Taxes on miscellaneous operating property.....	1,105,331	.....	716,467	388,864
37.	Miscellaneous operating income.....	5,878	.....	5,878	.....
38.	Total operating income.....	3,593	.....	3,593	.....
39.	Total operating income.....	2,285	.....	2,285	.....

	Totals, all districts	Eastern district, Federal	Southern district, Federal	Western district, Federal
40. Hire of freight cars—credit balance.....	18,281,832	5,383,069	4,815,173	8,083,590
41. Rent from locomotives.....	14,034,135	5,020,936	3,229,838	5,783,361
42. Rent from other equipment.....	14,162,870	5,736,310	1,444,439	6,982,121
43. Joint facility rent income.....	24,764,778	11,458,428	3,324,006	9,982,344
44. Miscellaneous rent income.....	8,606	2,656	3,161	2,789
45. Miscellaneous non-operating physical property.....	52,363	657	48,472	3,234
46. Separately operated properties—profit.....	21,748	.....	2,614	19,134
47. Income from funded securities.....	119,862	*1,460	78,009	43,313
48. Income from unfunded securities and accounts.....	8,954,769	5,405,024	1,387,962	2,161,783
49. Miscellaneous income.....	93,954,358	40,037,046	10,118,631	43,798,681
50. All other non-operating income.....	45,093	.....	.....	45,093
51. Total non-operating income.....	174,406,414	73,042,666	24,452,305	76,905,443
52. Gross income.....	892,861,006	318,016,064	171,965,749	402,879,193
53. Hire of freight cars—debit balance.....	35,791,216	27,010,695	2,953,364	5,827,157
54. Rent for locomotives.....	14,901,558	8,083,701	3,526,607	3,291,250
55. Rent for other equipment.....	11,062,880	6,746,652	1,536,518	2,779,710
56. Joint facility rents.....	45,391,048	21,269,387	5,622,201	18,499,460
57. Rent for leased roads.....	75	75	.....	.....
58. Miscellaneous rents.....	131,549	104,649	693	26,207
59. Miscellaneous tax accruals.....	53,256	53,256	.....	.....
60. Separately operated properties—loss.....	6,722	921	10	5,791
61. Interest on funded debt.....	476,779	242,800	92,991	140,988
62. Interest on unfunded debt.....	15,330,682	1,515,207	3,430,977	10,384,498
63. Miscellaneous income charges.....	.....	.....	.....	.....
64. All other income deductions.....	123,145,765	65,027,343	17,163,361	40,955,061
65. Total deductions from gross income.....	769,715,241	252,988,721	154,802,388	361,924,132
66. Net income.....	769,715,241	252,988,721	154,802,388	361,924,132
73. Income balance transferred to profit and loss.....	.....	.....	.....	.....

*Represents deficit, loss, or other item.

PROFIT AND LOSS ACCOUNT

1. Credit balance transferred from income.....	\$768,806,493	\$252,079,973	\$154,802,388	361,924,132
2. Profit on road and equipment sold.....	177,419	94,579	7,027	75,813
3. Delayed income credits.....	768,037	262,289	45,350	460,398
4. Unrefundable overcharges.....	5,950	3,358	1,066	1,526
5. Donations.....	2,286,911	532,879	264,436	1,489,546
6. Miscellaneous credits.....	772,044,810	252,973,076	155,120,317	363,951,415
7. Total credits during year.....	.....	.....	.....	.....
8. Surplus applied to sinking and other reserve funds.....	70	70	70	70
9. Dividend appropriations of surplus.....	.....	.....	.....	.....
10. Surplus appropriated for investment in physical property.....	.....	.....	.....	.....
11. Stock discount extinguished through surplus.....	.....	.....	.....	.....
12. Debt discount extinguished through surplus.....	.....	.....	.....	.....
13. Miscellaneous appropriations of surplus.....	.....	.....	.....	.....
14. Loss on retired road and equipment.....	875,366	643,059	37,216	195,091
15. Delayed income debits.....	692	217	.....	475
16. Miscellaneous debits.....	15,243,938	13,176,497	2,059,602	7,839
17. Total debits during year.....	16,120,066	13,819,773	2,096,888	203,405
18. Net increase during year.....	755,924,744	239,153,305	153,023,429	363,748,010
19. Balance at beginning of year.....	.....	.....	.....	.....
20. Balance at close of year.....	755,924,744	239,153,305	153,023,429	363,748,010

RAILWAY OPERATING REVENUES

21. Freight.....	3,417,672,172	1,549,592,398	544,591,634	1,323,488,140
22. Passenger.....	1,027,014,626	444,718,356	188,557,241	393,739,029
23. Excess baggage.....	5,910,514	2,015,079	954,660	2,940,775
24. Sleeping car.....	2,329,728	.....	123,294	2,206,434
25. Parlor and chair car.....	941,011	242,534	163,082	535,395
26. Mail.....	53,341,605	20,544,224	8,578,352	24,219,029
27. Express.....	125,710,500	61,631,380	16,630,118	47,449,002
28. Other passenger-train.....	7,846,683	2,703,509	1,065,828	4,077,346
29. Milk.....	19,157,627	14,585,253	817,792	3,754,582
30. Switching.....	43,844,039	23,252,971	5,100,788	15,490,280
31. All other rail-line revenue.....	9,990,570	7,175,297	955,106	1,860,167
32. Total rail-line transportation revenue.....	4,713,759,075	2,126,461,001	767,537,895	1,819,760,179
33. Total water-line transportation revenue.....	14,995,845	5,283,929	.....	9,715,916
34. Total incidental operating revenue.....	117,720,434	67,745,636	15,676,990	34,297,808
35. Joint facility—Cr.....	6,000,520	3,134,303	1,487,939	1,378,278
36. Joint facility—Dr.....	1,488,860	908,732	271,251	308,877
37. Total railway operating revenues.....	4,850,991,014	2,201,716,137	784,431,573	1,864,843,304

RAILWAY OPERATING EXPENSES

38. Total maintenance of way and structures.....	644,606,618	283,038,839	99,159,818	262,407,961
39. Total maintenance of equipment.....	1,094,825,873	531,810,501	175,351,777	387,663,595
40. Total traffic.....	48,263,234	20,777,136	9,136,523	18,349,573
41. Total transportation—rail line.....	2,007,862,605	977,531,536	303,725,857	724,605,212
42. Total transportation—water line.....	9,929,740	3,369,819	.....	6,559,921
43. Total miscellaneous operations.....	38,618,897	18,790,345	3,811,675	16,016,877
44. Total general expenses.....	110,064,096	49,290,850	16,824,021	43,949,225
45. Transportation for investment—Cr.....	6,038,863	767,193	885,136	4,386,534
46. Grand total railway operating expenses.....	3,948,132,200	1,883,841,833	609,124,537	1,455,165,830
47. Operating ratio (ratio of op. exps. to op. revs.)—per cent.....	81.39	85.56	77.65	78.03

ROAD OPERATED AT CLOSE OF YEAR

48. Miles of road.....	230,299.25	58,622.68	42,864.59	128,811.98
49. Miles of second main track.....	30,472.67	16,860.41	4,033.91	9,578.35
50. Miles of third main track.....	2,816.28	2,500.33	42.42	273.53
51. Miles of fourth main track.....	2,000.07	1,791.71	29.20	179.16
52. Miles of all other main tracks.....	229.76	46.44	159.59	23.73
53. Miles of yard track and sidings, etc.....	102,080.90	41,704.45	16,336.96	44,039.49
54. Total miles of road operated (all tracks).....	367,898.93	121,526.02	63,466.67	182,906.24

FREIGHT TRAFFIC (TONNAGE ORIGINATING ON ROAD)

55. Total products of agriculture.....	116,713,747	29,051,534	16,153,805	71,508,408
56. Total products of animals.....	35,806,611	11,653,396	3,412,650	20,740,565
57. Total products of mines.....	712,259,938	379,307,905	135,391,864	197,560,169
58. Total products of forests.....	97,658,170	19,993,139	30,934,825	46,730,266
59. Total manufactures.....	181,676,957	113,888,987	24,494,234	43,293,736
60. Miscellaneous commodities (carload rates).....	46,683,541	31,476,018	7,625,594	7,581,929
61. L. C. L. goods not distributed above.....	53,580,396	28,052,375	8,411,869	17,116,152
62. Grand total, all commodities.....	1,244,379,360	613,423,354	226,424,841	404,531,165

STATISTICS OF RAIL LINE OPERATIONS

Train-miles

63. Freight—ordinary.....	599,258,043	241,628,547	118,766,581	238,862,915
64. Freight—light.....	12,976,642	6,283,438	1,995,571	4,697,633
65. Passenger.....	526,320,026	214,655,652	91,522,765	220,141,609
66. Mixed.....	28,553,638	4,214,677	4,914,006	19,424,955
67. Special.....	1,449,779	775,443	127,581	546,755
68. Total transportation service.....	1,168,558,128	467,557,757	217,326,504	483,673,867
69. Work service.....	43,912,850	22,843,966	7,192,343	13,876,541

No.	Item	Totals, all districts	Eastern district, Federal	Southern district, Federal	Western district, Federal
Locomotive-miles					
1.	Freight—principal	616,810,600	251,261,053	121,081,625	244,467,922
2.	Freight—helper	54,372,010	32,135,455	10,198,338	12,038,217
3.	Freight—light	36,379,216	19,719,302	3,590,285	13,069,629
4.	Total freight	707,561,826	303,115,810	134,870,248	269,575,768
5.	Passenger—principal	511,737,832	207,080,027	91,569,734	213,088,071
6.	Passenger—helper	9,996,972	4,441,663	1,369,947	4,185,362
7.	Passenger—light	14,030,124	7,896,507	1,613,028	4,520,589
8.	Total passenger	535,764,928	219,418,197	94,552,709	221,794,022
9.	Total mixed train	29,478,342	4,329,621	4,992,384	20,156,337
10.	Total special	1,583,791	795,054	142,673	646,064
11.	Train switching	48,060,592	27,038,046	5,702,850	15,319,696
12.	Yard switching—freight	337,500,767	187,565,946	49,301,683	100,633,138
13.	Yard switching—passenger	24,167,842	14,166,813	2,837,704	7,163,325
14.	Total transportation service	†1,687,755,773	†758,952,570	†293,514,853	635,288,350
15.	Work service	54,764,257	30,243,055	8,398,698	16,122,504
Car-miles					
16.	Freight train—loaded	14,823,569,433	6,367,268,466	2,647,941,176	5,808,359,791
17.	Freight train—empty	7,066,107,922	3,178,311,905	1,339,521,311	2,548,274,706
18.	Freight train—caboose	613,654,420	247,329,032	121,262,492	245,062,896
19.	Total freight train	22,503,331,775	9,792,909,403	4,108,724,979	8,601,697,393
20.	Passenger train—passenger	1,342,710,352	587,173,444	238,334,800	517,202,108
21.	Passenger train—sleeping, parlor and observation	733,611,096	267,546,555	126,645,325	339,419,216
22.	Passenger train—dining	107,192,787	33,508,124	15,917,748	57,766,915
23.	Passenger train—other	1,044,056,243	438,640,893	164,942,653	440,472,694
24.	Total passenger train	3,227,570,478	1,326,869,019	545,840,526	1,354,860,933
25.	Mixed train—freight—loaded	133,607,855	16,625,485	19,002,183	97,980,187
26.	Mixed train—freight—empty	59,460,172	7,884,679	8,390,076	43,185,417
27.	Mixed train—caboose	3,536,602	528,068	418,929	2,589,605
28.	Mixed train—passenger	41,397,889	6,205,557	8,465,951	26,726,381
29.	Mixed train—sleeping, parlor and observation	2,961,248	303,758	580,988	2,076,502
30.	Mixed train—dining	21,035	8,315	1,517	11,203
31.	Mixed train—other passenger train	10,869,384	2,168,290	1,647,538	7,053,556
32.	Total mixed train	251,854,185	33,724,152	38,507,182	179,622,851
33.	Total special train	18,584,191	9,199,689	1,433,175	7,951,327
34.	Total transportation service	26,001,340,629	11,162,702,263	4,694,505,862	10,144,132,504
35.	Work service	178,380,421	57,391,281	34,909,730	86,079,410
MISCELLANEOUS					
36.	Tons—revenue freight	2,269,861,026	1,314,179,513	341,294,735	614,386,778
37.	Tons—non-revenue freight	234,150,197	99,088,444	41,118,063	93,943,690
38.	Ton-miles—revenue freight	398,442,019,620	185,461,512,568	72,101,218,370	140,879,288,682
39.	Ton-miles—non-revenue freight	34,537,001,168	10,687,229,012	6,376,550,032	17,473,222,124
40.	Passengers carried—revenue	1,080,484,737	673,197,946	145,482,405	261,804,386
41.	Passenger-miles—revenue	42,566,342,892	19,500,136,137	7,405,114,433	15,661,092,322
42.	Ton-miles—revenue freight—per mile of road	1,729,183	3,162,751	1,671,939	1,094,985
43.	Ton-miles—revenue freight—per train-mile	621.80	735.59	573.71	535.69
44.	Ton-miles—revenue freight—per loaded car-mile	26.64	29.05	27.04	23.85
45.	Passenger-miles—revenue—per train-mile	76.71	89.09	76.79	65.37
46.	Passenger-miles—revenue—per car-mile	20.07	22.64	19.80	17.69
47.	Miles hauled—revenue freight	175.54	141.12	211.26	229.30
48.	Miles carried—revenue passengers	39.40	28.97	50.90	59.82
49.	Revenue per ton of freight	\$1.50567	\$1.17913	\$1.59566	\$2.15416
50.	Revenue per ton-mile of freight	\$0.00858	\$0.00836	\$0.00755	\$0.00939
51.	Revenue per passenger	\$0.95051	\$0.66061	\$1.29608	\$1.50394
52.	Revenue per passenger-mile	\$0.02413	\$0.02281	\$0.02546	\$0.02514
EQUIPMENT (OWNED OR LEASED) IN SERVICE AT CLOSE OF YEAR					
53.	Steam locomotives—number available for service	62,988	29,070	10,411	23,507
54.	Steam locomotives—total tractive capacity (pounds)	2,200,964,462	1,052,489,873	366,242,100	782,232,489
55.	Other locomotives—number available for service	342	278	112	52
56.	Box cars—number	1,032,176	429,989	168,284	433,903
57.	Flat cars—number	110,201	27,899	27,029	55,273
58.	Stock cars—number	86,931	13,841	9,870	63,220
59.	Coal cars—number	917,734	583,253	185,619	148,862
60.	Tank cars—number	9,792	486	27	9,279
61.	Refrigerator cars—number	62,841	24,757	6,751	31,333
62.	Other freight-carrying cars—number	86,633	26,298	4,196	56,139
63.	All freight-carrying cars—number	2,306,308	1,106,523	401,776	798,009
64.	Total passenger-carrying cars—number	35,429	17,873	4,817	12,739
65.	Other passenger-train cars—number	18,184	9,263	2,594	6,327
66.	Total number of passenger-train cars	53,613	27,136	7,411	19,066

†Includes 3,637,685 miles in yard-switching service.

‡Includes 2,523,083 miles in yard-switching service.

§Includes 1,114,602 miles in yard-switching service.

The interest on funded and unfunded debt accrued by the Class 1 corporations amounted to \$425,774,298 as compared with \$418,229,507 in the calendar year 1917.

The corporations, although they did not operate their properties, show some entries against operating revenues and expenses. This is explained by the fact that some of the accounts of 1917 were not settled until after the close of that year. Most of the overlap items, however, appear in the income and profit and loss accounts.

The summary of federal operations is an aggregate of the reports of the individual operating units and does not include the expenses of the regional and central offices of the United States Railroad Administration, amounting to \$3,647,143.23. No showing is made of the general financial transactions of the Railroad Administration, which must be obtained from reports by the director general of railroads.

The aggregate income accounts of the Class 1 operating roads under federal control show an operating income as defined in the federal control act of \$682,555,220. The standard return for these roads is approximately \$891,000,-

000. The standard return is not entered in individual reports of federal operations. Attention is called to the items of \$93,954,358, miscellaneous income, and \$15,330,682, miscellaneous income charges, which include the 1917 overlap items of operating expenses and revenues passing through the federal books.

The summaries covering the corporate reports and those of federal operating are given in this article.

Summary No. 3 covering the Class 1 roads not operated by the Railroad Administration covers 2,929 miles of road operated, which had railway operating revenues amounting to \$29,211,246, railway operating expenses amounting to \$23,677,956, and railway operating income amounting to \$3,144,613.

THE COALING PLANT which is to be erected in the harbor of Melbourne, Australia, when completed will consist of four electrical hoists with grab buckets, which pick up four or five tons of coal at a time and deliver it to mechanically operated conveyors, which in turn, will carry to bins of 30,000 tons capacity.

Putting Our Railways on a Business Basis*

Factors Are Suggested Which Are Vital to a Satisfactory Solution of the Railway Problem

By Alba B. Johnson

President Railway Business Association.

WHAT LEGISLATION is to be passed in order to make it possible for the owners to operate their railroads without bankruptcy, has become a question pressing upon the public attention more strongly than any other at this time, save only that of the League of Nations and the Peace Treaty. We have had two years in which to think it over; yet when the time is approaching, not a matter of months, but a matter of weeks, when this problem must be solved, we find ourselves with some 36 plans offered, of which no less than seven have become widely known. The voice of the business men of the United States has been a discordant medley. Every conceivable plan has been urged for consideration. The Railway Business Association has prepared no plan, but has felt that there are certain principles which are involved, and if these principles are adopted, we care not what plan embodies them.

National Chamber Referendum

The directors of the Chamber of Commerce of the United States received the report of their Railroad Committee on the first of May last. The polls closed on the referendum July 24. The voice of the country was almost unanimous in approving such of these recommendations as favored private operation of railways and certain other principles; but since July 24, although this question changes its aspect daily, the Chamber of Commerce has been constrained to restrict its discussion to the precise recommendations upon which the constituent bodies voted in July.

This restriction is due to a rule of the Chamber which the Railway Business Association voted for when it was adopted and which we approve now. We would deplore any impairment of the system under which after deliberate study by a competent committee upon a subject of first national importance the Chamber submits the fundamentals to the business organizations of the country for a dignified and impressive expression of deliberate and enlightened opinion, the Chamber never speaking business sentiment without having ascertained it. No doubt some of the constituent bodies misunderstand this process. There is evidence that many of them expect the Chamber officers to go outside the scope defined in the referendum, believe that it does so, and fold their hands in confidence that great national measures will be carried to enactment with constant and always up-to-the-minute participation by organized business without their doing anything after voting.

That the Chamber recognized the need for supplementary machinery was shown when it authorized the calling of the National Transportation Conference, conducted under auspices of the Chamber but in no way authorized to speak for it. All the members of the Railroad Committee were appointed members of the Conference and several of them participated actively. The result was one of the seven leading plans—a plan containing matter in several aspects vitally wider than the referendum. The conferees sat as individuals. They bore no commission from organizations. They had no ways or means of rallying the constituents of the Chamber to their plan.

Cooperative Committee

In these circumstances Harry H. Merrick, president of the Chicago Association of Commerce and also of the Mississippi Valley Association, arranged for a conference of officers of organizations in Atlantic City at the time of the International Trade Conference in October. Among those who accepted the invitation to be present were National Chamber officers—the chairman of the executive committee, a director, the chairman of the Railroad Committee and the general secretary. These officers were asked whether they saw any objection to the formation of a committee, representing constituent bodies, to discuss principles not inconsistent with the Chamber referendum and others not dealt with by it; and if so whether the Chamber would prefer or not to act as recipient of replies to a circular inviting cooperation from associations.

As to the second question, attention was called to the difficulty, as shown by experience, of making members of Congress understand the distinction between official recommendations of the Chamber and those of groups to which it merely lends its good offices; and it was suggested that the proposed committee keep itself wholly independent.

As to the first main question, a statement was made and was subsequently used by the Chamber in answering inquiries by constituent bodies, that the proposed independent activity of a group of associations was deemed entirely proper.

The Atlantic City conferees, including officers of four national and seven city associations, agreed to constitute themselves into what is called the Cooperative Committee on Railway Legislation. The chairman is Mr. Merrick.

Recommendations

What will the Cooperative Committee urge upon Congress? This is for the Committee to say; but I hope they will put some questions to all those who are engaged in agriculture, mining, industry or commerce. These are the questions:

I. Defective Governmental Policy

Do you not believe that apart from misdeeds of railway managers and financiers, which should be restrained, and apart from their assertions of poverty, which are a matter of business judgment, the impairment of railroad credit has been in part due to the policy of the federal and state governments in the regulation of rates?

Managers Made Scape-Goat

In support of the assertion that the railroads were themselves responsible for the impairment in their credit, it has been declared that railroad-wrecking had spread its odium over properties otherwise sound and that the managers by their calamity-howling had "beared" their own credit; so that if these two elements were eliminated no change in government regulation of rates would be necessary. But investors do not invest on "front" or refrain from investing on second-hand odium; they act on expert advice, which is based on knowledge with regard to each individual property as to its income and prospects of income, and as to the integrity and stability of its management. Practically no

*An address delivered before the American Mining Congress at St. Louis, November 17, 1919.

influence is exerted upon investment in a strong road by misdeeds or misfortunes afflicting other roads. Each road stands or falls on its own condition.

As for calamity-howling, are railway managers seriously supposed to think that statements of inadequate income laid before rate tribunals can escape the eye of those who advise investors? In any event every railroad board includes, quite properly, bankers who make a part of their living as wholesalers of securities. Who believes that they would consent, as railroad directors, to a campaign certain to curtail their dealings as bankers, if the income situation had not become desperate beyond remedy within the reach of the managers and financiers? Railroad boards contain the ablest, most successful, best respected and most fully trusted men in the country—merchants, manufacturers, professional men.

To accuse such men either of imbecility or villainy of this sort is to indict the best there is in the nation. It is incredible. It is not true.

Credit can only be restored by adapting the policy of the government to the course of events. Such a change in policy is long overdue. It should wait no longer.

Attitude of Congress

What is the apparent attitude of the two branches of Congress on this vital point?

The House bill, which has been passed, leaves the Interstate Commerce Commission without obligatory mandate to permit such rates as will yield revenue sufficient to attract capital. The spirit of the House committee is, we fear, indicated by the annexation to their report of a statement by Interstate Commerce Commissioner McChord, who says: "Whatever decline there was in railway credit previous to federal control was not due to any action of the Interstate Commerce Commission."

The Senate bill attacks the credit question directly and in a mandatory manner, requiring that such rates be permitted as will yield a specified rate of return on the value of the property. The Senate committee report, moreover, has this: "Legislation . . . must tender to the future investor . . . reasonable assurance of such yearly return as will induce him to enter the field. . . . It is here that our present system of regulation has failed."

It is the task of citizens to aid the Senate committee in commanding support in the Senate for the position set forth in that quotation and to persuade the House to concur.

II. Federal Jurisdiction Over Rates

Since the federal authorities must sanction adequate total revenue for all roads from all sources, do you not believe that any business-like regulation of carriers which are parties to interstate hauls requires that all rates of all such carriers shall be under the jurisdiction of federal authorities?

Neither the railroads nor any line of public business can be successfully regulated by 49 regulatory bodies. In order to prevent discrimination and undue burden on interstate commerce through state regulation, every carrier which hauls any interstate cargo should be subject to the regulation of all its rates by the federal authority.

III. Adequacy of Rates

Do you not believe that resumption of railway development requires, among other things, that Congress supplement its present statutory policy of restrictions only, by enacting that rates shall be such as to yield revenue sufficient for necessary expenses and for the credit basis which will enable the average road to secure improvements and extensions?

This applies to the proposition contained in Question I. That was that Congress should recognize the necessity for a change in government regulation in order to restore railway

credit. Question III deals with one of the essentials in carrying out that proposal. The law as it stands gives the jurisdiction over each individual rate as to its justness and reasonableness. The Commission has no authority to sanction whole rate structures primarily to yield a certain amount of total revenue. The Senate committee bill explicitly bestows such power. The House bill does not. Such power should be a feature of the act.

IV. Advance Ascertainment and Report of Needs

Do you not believe that an indispensable requirement in putting the railways on a business basis is that the regulatory authorities at workable intervals ascertain for a forthcoming period the transportation needs of the country, and report to Congress or to the public their findings as to such needs and their estimate of the necessary revenue?

The House committee bill as introduced provided that the Commission should keep itself informed of transportation needs and operating revenues necessary to adequacy and efficiency of facilities and service. Newspaper despatches not yet verified in detail indicate that possibly this passage was eliminated on the floor.* Even if left in, it does not require the Commission to keep the public informed. The Senate committee bill provides for a similar inquiry by a Transportation Board, which is to certify its findings to the Commission, such certificate to be prima facie evidence. Whether there is to be a new board or not the results of such observation and study should be a public report of findings, and such report should cover, not past periods, like the statistics of large-scale rate-advance cases hitherto, but the future. We do not care anything about the water that has passed over the dam. You have to be prepared for the flood that is coming.

V. Announcement of Necessary Rate of Return

Do you not believe that in estimating the net income required for each group in order to attract capital in the amount approved as necessary the regulatory authorities should have the power and the duty to ascertain and announce the rate of return which under money market conditions at a given time it is necessary to allow?

"And announce." Nothing is more vital. If the regulatory authority is required to announce its estimates as a whole, and specify what rate of return this is based upon, the public will be able at all times to judge what, if any, adjustments are required to bring the estimates into line with the facts; the public, with this complete understanding of the situation, will acquiesce in such adjustments; the Commission, having set a mark to attain, will itself realize with some exactness what is required of it and bend every energy toward performance.

Are you not willing to help Congress put the railways on a business basis without regard to your preferences as to methods, by informing Senators and Representatives what you and others, whose view you have ascertained, regard as the necessary objects of railway legislation?

This last question may be summarized in two words—"Get busy." Now is the time. These next thirty days or less may be the time during which this great question of the future condition of the railways of the United States is to be established, not for next year or for the next ten years, but for an indefinite period ahead—possibly for all time.

*On the day this address was delivered the House in passing the bill eliminated the following: "The Commission shall be charged with the duty and responsibility of observing and keeping informed as to the transportation needs and the transportation facilities and service of the country, and as to the operating revenues necessary to the adequacy and efficiency of such transportation facilities and service. In reaching its conclusions as to the justness and reasonableness of any rate, fare, charge, classification, regulation or practice, the Commission shall take into consideration the interest of the public, the shippers, the reasonable cost of maintenance and operation (including the wages of labor, depreciation, and taxes), and a fair return upon the value of the property used or held for the service of transportation."

Electrification of the South African Railways

Estimated Net Expenditure of \$50,000,000 to Equip 860 Route Miles—Direct Current to Be Used

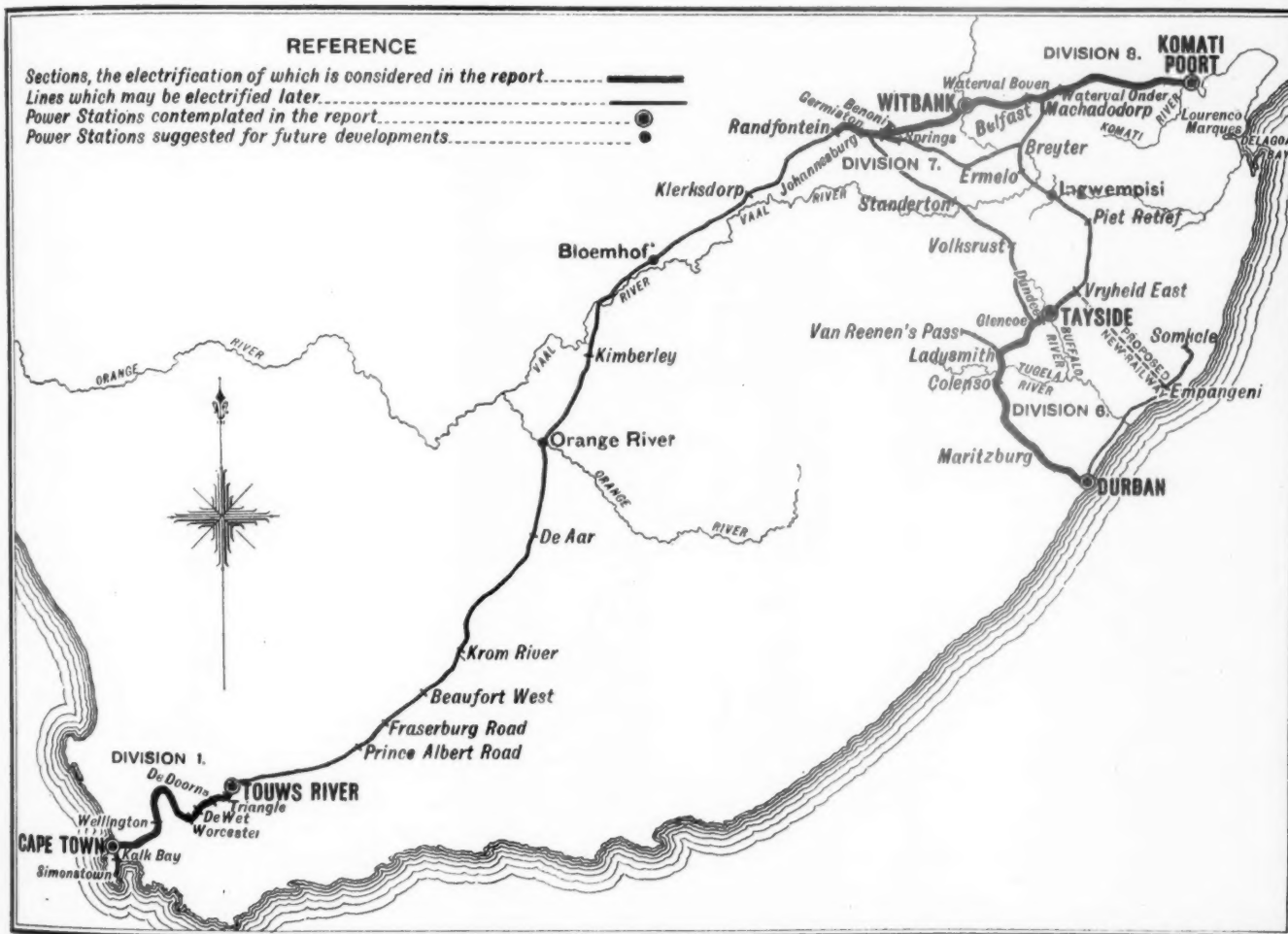
By Robert E. Thayer
European Editor of the *Railway Age*.

THERE HAS BEEN PUBLISHED in London recently by Merz & McLellan, consulting engineers, a most complete report on the proposed electrification of portions of the South African Railways. There is so much interest in this report that an abstract is given below:

The South African Railways in preparation for an increase in traffic has given consideration to electrification of the more congested portions of its line by means of which heavier trains can be handled at higher average speeds than

and transmission lines. A credit of £5,033,197 was deducted from the estimated gross total expenditure on account of the equipment that would be released from actual service in the electrified portions and on account of the cost of alterations to the lines and the additional equipment that would have been required to provide for an increase of 50 per cent in traffic under steam operation. The return on the net capital expenditure is estimated to be £801,900.

With the existing conditions in South Africa it has been



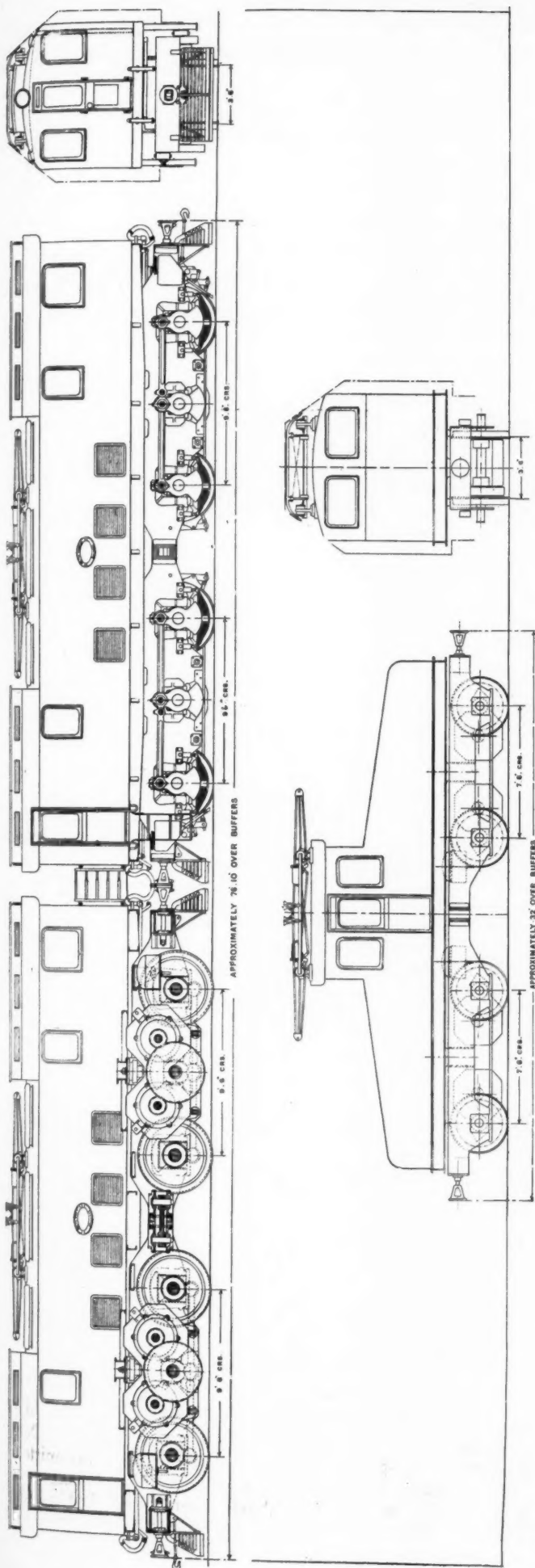
Map of South African Railways

is possible at present. As an alternative to electrification material changes would have been made on the road as in some cases the traffic density has about reached the limit of that which can be handled.

The proposed plans contemplate an increase of traffic at 50 per cent over the electrified portions with the present trackage. Four portions of the lines are considered, which involve 860 route miles and a total trackage, including yards, sidings, etc., of 1,219 miles. The estimated net capitalization involved for this electrification amounts to £11,670,485 of which £6,396,350 is the estimated cost of power stations

deemed practical to operate electrified portions by direct current at 3,000 volts. The power will be generated in the form of three-phase alternating current at a frequency of 50 cycles.

The report recommends electric freight locomotives weighing 268,800 lb., having a tractive effort of 48,000 lb. for one hour and 64,000 lb. for short periods such as when starting a train. With the maximum traffic effort a factor of adhesion of 4.2 is obtained. For passenger service a locomotive of 161,280 lb. has been recommended which will have a tractive effort of 30,000 lb., one hour rating, and



Electric Freight and Shunting Locomotives Proposed for the South African Railways

adaptability of this system for long distance freight and passenger traffic. The chief objection to the use of the direct current system as compared with the single phase system is that more substations will be required. On the Chicago, Milwaukee & St. Paul the average distance between substations is about 32 miles and in the present case it is believed that sub-stations could logically be placed from 25 to 30 miles apart. A further objection to the direct current is that of designing the driving equipment for locomotives and motor coaches for 3,000 volts, but regardless of the fact that the narrowness of the gage of the South African railways, which is 3 ft. 6 in., presents its limitations, it has been possible to design suitable equipment. The gage, however, will not permit of placing the motors between the driving wheels, and the design of the locomotive involves the use of outside connecting rods, coupling the crank on each pair of driving axles to those of a central jack shaft which is driven through gearing by a pair of motors.

The use of direct current enables a simple construction of electrical equipment for the motor cars and locomotives in which the first cost is low and the maintenance easy and cheap. It provides for variable speeds and is well adapted to the requirements of a general system including suburban and main line traffic. In view of the several heavy grades mentioned above the use of regenerative braking is desirable. While the use of this feature is most easily accomplished with 3-phase motors it can be applied to direct current motors with the added advantage that the motors can be worked regeneratively over a wide range of speeds whereas with the 3-phase motors the current can be regenerated continuously only at one or two different speeds.

An overhead wire over the centre of each track supported at intervals by steel structures is believed the most desirable for the conditions in South Africa. The general arrangement proposed is the same as that already adopted for the electrified Sheldon-Newport branch of the North Eastern Railway in England. The contact wire is to be supported by a catenary and the line is to be divided into sections by the means of section isolators.

It is planned to locate the sub-stations at Kalk Bay, two at Cape Town, Booth Junction (near Durban), Maritzburg, Ladysmith, Glencoe and at suitable intervals between the power stations which are to be located at Cape Town, Tows River, Witbank, Komati Poort, Tayside and Durban.

The location of the generating plants required considerable study. Because of the fact that the divisions to be electrified are so far from each other, with the exception of Divisions 7 and 8, this problem had to be considered separately with a view of possible extension of the electrification system.

The possible use of water power was carefully studied, but the rainfall in South Africa is very irregular and the flow of water in most of the rivers crossed by the portions of the railway under consideration is unreliable and occasionally ceases altogether. Even the Orange and the Vaal rivers have been known to cease flowing altogether and this is a common occurrence with other rivers of less importance. Thus hydro-electric plants are out of the question. Furthermore in South Africa coal at the pit is cheap and the cost of freight is low, which again favors the use of steam-driven generating plants.

In deciding the location of the power sites, the security of supply was carefully considered and they were chosen with the idea of enabling duplication of work. Thus in Division 6 it is recommended that power plants be located at Tayside and Durban. In Division 7, a power plant is to be located at a station on the Great Olifants river. In this locality, however, it is possible to draw power from the Victoria Falls and Transvaal Power Company. For Division 8, it is recommended that power plants be located at

Komati Poort on the Komati river which with an increase of capacity of the Great Olifants river plant would be able to take care of that division. In Division 1 it is recommended to place the plants at Cape Town and Touws river. The Cape Town plant will provide power for the suburban branches around Cape Town and for a portion of the main line to Touws river. Although the distance between Cape Town and Touws river is only 160 miles by rail, it was considered inadvisable to depend upon a single source (Cape Town) and a transmission line of this length for a supply for the whole section and it was therefore recommended that the Touws river plant be included.

In considering the general question of power supply the report states that the engineers had in mind the possibility of supplying power to municipalities and possibly to private consumers in addition to the railways. It is believed that it would be a mistaken policy to regard railway electrification as distinct from the general use of electricity throughout the country. The majority of the power undertakings in South Africa have already adopted the 3-phase alternating current with a frequency of 50 cycles which would make co-operative working a simple matter. A splendid opportunity presents itself for co-operative working for a large power plant at Cape Town as the municipality of Cape Town will in the near future be obliged to increase its power facilities.

For the entire electrification project twenty-four 8,000 k. w. units and two 5,000 k. w. units have been suggested, distributed as follows:

Cape Town—Eight 8,000 k.w. units.
Touws River—One 8,000 k.w. unit.
Durban—Four 8,000 k.w. units.
Tayside—Three 8,000 k.w. units.
Great Olifants River—Eight 8,000 k.w. units.
Komati Poort—Two 5,000 k.w. units.

Electric Motive Power

As above mentioned it is believed advisable to use electric locomotives for main line passenger and freight trains and for switching work with multiple unit system for the suburban traffic.

Electric freight locomotives.—In South Africa where all the cars are fitted with air brakes, the controlling feature is the drawbar pull required to haul the train up the ruling grade. Investigation showed that the draft gear on some of the freight cars (which is to be systematically placed on all of the freight cars) was of a sufficient strength to enable a train of 1,800 short tons to be hauled up a grade of one per cent. This corresponds to a pull of about 48,000 lb. An electric freight locomotive was therefore designed to meet these conditions and the characteristics suggested were that it should have a tractive effort of 48,000 lb. and weigh 268,000 lb. The locomotives are designed for hauling a 1,200-ton train composed of loaded cars at a speed of about 40 m. p. h. on the level, or a train of 1,800 tons at not less than 30 m. p. h. Furthermore, they are designed to operate at a speed of 20 to 23 m. p. h. up to the ruling grade. Thus a substantial increase in general speed in freight trains is anticipated. The actual horse power of the proposed freight locomotives under these conditions works out at about 2,800 (one hour rating). This may be compared to from 1,000 to 1,400 h. p., the capacity of the present steam locomotives. The general arrangement of these locomotives is shown in Figure 3.

Electric passenger locomotives.—The average maximum load of the passenger train is about 600 tons. Platform and station accommodations generally limit the number of coaches per train to a maximum of 15 or 16. The maximum grade of any of the sections under construction on which a special passenger locomotive would be used is 2.5 per cent. Thus a tractive effort of about 40,000 lb. would be required. Inasmuch as these maximum grades are comparatively short

and few, it was believed better to use a pusher in addition to the train engine and for that reason passenger locomotives of 161,280 lb. exerting a tractive effort of 13,000 lb. at one hour rating and a maximum tractive effort of 38,400 lb. were proposed. This locomotive would be able to haul a 600-ton train up a 1.67 per cent compensated grade without assistance and would be amply sufficient for all probable requirements.

Speed restrictions due to local conditions will not permit speeds higher than 60 m. p. h. and for that reason these locomotives have been designed for a normal speed on the level with a train of 15 main line coaches of not less than 55 m. p. h., or 28 to 29 m. p. h. on the grades. The design of the express passenger locomotive is similar to the freight locomotives with the addition of a leading four-wheel truck to adapt these engines to the higher speed. The use of this special design of passenger locomotive will, under the extent to which present electrification is to be carried, be restricted to Division 1, for on the other divisions there are but few places where a high speed is possible owing to the large number of sharp curves. It is therefore suggested that single-unit electric freight locomotives should be used on Divisions 7 and 8 for passenger and double-unit electric freight locomotives on Division 6, where the trains are heavy and the grades severe.

Electric shunting locomotives.—A large amount of shunting has to be carried out at Cape Town, Durban and Kendal, and for this purpose a special shunting locomotive has been recommended. It is of the double truck type, with a center driver's cab, weighing about 135,440 lbs., and has a tractive effort of 14,000 lbs. at 12 m. p. h. It is planned to have the electrical equipment practically identical with that of the passenger coaches of the suburban passenger trains.

Anticipated Results From Electrification

One of the chief reasons for the electrification of the South African lines was the purpose of increasing the capacity of the tracks as they now stand. The investigations were based on a 50 per cent increase in traffic. This is to be brought about by the increase in the average speed at which the trains will be operated and by increasing the train load so that greater tonnage can be hauled with a fewer number of trains. As most of the sections under consideration are single track lines, a reduction in the number of trains and an increase in speed will produce a great improvement in regard to delays at stations.

With electrical operations the average speed of the two different classes of traffic will be more equal than it is at the present time and there will be less necessity of side tracking the slower traffic. An example of what this means on the run between Witbank and Germiston is illustrated by the diagram in Fig. 2. The full lines show a record of an actual test with a steam locomotive commonly used on this line loaded to 600 tons, and the dotted lines show the calculated speed for the same load with an electrical locomotive. Electrically hauled trains will take 2 hours 40 minutes, exclusive of stops, as compared with 3 hours 45 minutes for the steam train, or a reduction of nearly 30 per cent in the running time. The saving of time on other sections is even greater. For instance, the running time for fast freight trains from DeDorns to Touws river, allowing one intermediate stop for water, is at present 2 hours 24 minutes, whereas with the electrically operated train the same distance will be covered in 1 hour 12 minutes. In passenger service the present running schedule between Cape Town and Touws river is 7 hours 50 minutes, whereas under electrical operation the journey could be done in 5 hours 45 minutes.

In regard to the suburban passenger trains operated under the multiple-unit system it is the universal experience that

such improvements in travelling facilities produce a larger volume of traffic, which is due to a growth of the population in the remoter suburbs and to more frequent use of the improved services.

With the increase in speed less equipment will be required to handle the same amount of traffic. There will be a reduction in the amount of coal consumed, with the accompanying decrease in the number of cars used for the transportation of company coal. There will be an increase in engine mileage. In the case of the freight service between Glencoe and Durban the yearly mileage of the electric locomotives would be at least 70,000 miles. Thus fewer electric locomotives will be required. In this respect it is estimated that with 262 electric freight, passenger and shunting locomotives and 136 motor coaches, 448 steam locomotives would be available for sale or service elsewhere and that the 152 steam locomotives would not have to be purchased in order to deal with the 50 per cent increase in traffic the 262 electric locomotives and 136 motor coaches are expected to handle. In addition to this, electrification would, on account of increase in speed and the reduction in fuel consumed, make unnecessary the purchase of 1,038 new 40-ton freight cars, or their equivalent, which would be required for dealing with the increased demands under steam operation.

The decrease in annual train mileage, considering the estimated 50 per cent increase in traffic, is well illustrated in the through freight service. With steam locomotives it has been estimated that train mileage of the four divisions would be 9,846,800 miles, and with electric operation this would be 6,890,610 miles, or a saving of 2,956,190 train miles, or 30 per cent.

The saving in working expenses involves a comparison of the cost, under steam operation, of coal, water, wages of train crews, engine house expenses, lighting and heating, locomotive repairs, depreciation with, under electric operation, the cost of electrical energy, wages of train crews, engine house expenses, repairs and depreciation of the locomotives and motor equipment, depreciation, maintenance and working expenses of the sub-stations and the maintenance of the track equipment necessary for electrification. On the four divisions the estimated profit for electrical operation amounts to £801,900.

Capital Expenditures

The various items of capital expenditure involved in the electrification of these lines involves the cost of new rolling stock, electric locomotives, etc., the cost of the distribution system, the cost of the sub-stations and the cost of the power plant and transmission lines. There are other items, such as alterations to engine houses, telegraph and telephone lines, lengthening of sidings, etc. The net outlay on rolling stock is obtained by deducting from the gross expenditure for the new electric locomotives or train equipments the value of the existing steam locomotives displaced, the new steam locomotives that would be required for the additional traffic under consideration, the new wagons that would be unnecessary to purchase on account of the increased speed of the traffic, and the new wagons that it would be unnecessary to purchase due to the reduction in fuel consumption. The cost of the distribution system and sub-stations present an entirely new item of expenses, from which there is nothing to be deducted.

There are, however, additional credits which enter into the present discussion, such as the cost of alterations in the track to handle the 50 per cent increase in traffic under steam working, and which would not be necessary by electrical working. A balance of these items, exclusive of the power stations and transmission lines, show the estimated net capital outlay to be £5,274,153. The cost of power stations

and transmission lines had not been included in this estimate because of the possibility of purchasing power from various outside sources. However, in the working expenses interest at 5 per cent per annum on the capital required for new stations and transmission lines in event of the railroad producing its own power is included, together with a depreciation charge of 3 per cent on the power stations. The estimated capital outlay on power stations and transmission lines amount to £6,396,350. The net return on the net capital outlay, exclusive of the cost of power stations and transmission lines, is approximately 15 per cent. If the cost of the power stations and transmission lines are included the net return would be approximately 7 per cent.

War Time Fuel Restrictions Ordered

THE LOSS OF COAL PRODUCTION during the strike has so reduced the Nation's coal supply that restrictions in the use of coal paralleling those put into effect during the war were ordered on the very eve of the proposed settlement of the strike.

The fuel administrator, Dr. Harry A. Garfield, on December 8, issued the following order giving the Railroad Administration authority to issue regulations covering the delivery, use and consumption of coal, coke or other fuel or of power generated or produced by the use or consumption of coal, coke or other fuel:

"The United States Fuel Administrator acting under authority of an Executive Order of the President of the United States, dated 23 August, 1917, and of subsequent Executive Orders, and in furtherance of the purpose of said Orders, and of the Act of Congress therein referred to and approved August 10, 1917.

"*Hereby orders and directs* that the Director General of Railroads and his representatives acting by and under his authority be, and they thereby are, authorized and empowered to make and prescribe such local or general regulations restricting the delivery, use and consumption of coal, coke or other fuel or of power generated or produced by the use or consumption of coal, coke or other fuel as may from time to time be necessary in the present emergency. All regulations made pursuant to the authority hereby granted shall be valid and binding as and for regulations of said Administrator.

"This order shall be effective December 8, 1919."

On December 1, the fuel administrator gave out a statement urging the conservation of coal for these uses and suggested that local authorities adopt regulations and put them into effect to carry out this purpose.

A careful survey of the coal situation indicates that even if there is a prompt settlement of the coal strike, it will take some time to adjust the country to a normal basis and that, therefore, certain restrictions will have to be placed on the consumption of bituminous coal and of light, heat and power derived therefrom, so that urgent domestic needs may be cared for, the necessary food stuffs produced and really essential light, power and heat supplied. Already in many parts of the country restrictions as to the use of coal and coke for lighting and heating purposes and for the production of electricity and power for such purposes have been adopted. Regulations were tonight issued to make such restrictions uniform over the country and thus aid in the conservation of coal. They follow:

"Pursuant to authority of the United States Fuel Administrator the following regulations governing the use of heat, light and power from bituminous coal and coke are made effective generally and uniformly in the interest of conser-

vation of existing fuel supplies, and supersede any previous instructions:

LIGHT FROM BITUMINOUS COAL AND COKE.

1. No ornamental lights, white way or other unnecessary street lights, outline lighting, electric signs or illuminated billboards, show window or show case lights, are to be operated. This does not affect street lighting necessary for the safety of the public.

2. No cabaret, dance hall, pool hall or bowling alley shall be permitted to use light except between 7 p. m. and 11 p. m.

3. Stores, including retail stores but excepting stores selling food, and warehouses must not use light (except safety lights) except for six hours per day. Manufacturing plants shall be allowed to use light only during the time prescribed for the use of power.

Exceptions:

(a) Drug stores and restaurants may remain open according to present schedules, but must reduce lighting one half.

(b) Railroad stations, hotels, hospitals, telephone, telegraph and newspaper offices are not included insofar as necessary lighting is concerned.

(c) General and office lights must be cut off not later than 4 p. m. in office buildings except necessary federal, state and municipal offices, and except where office operation of vital industries is involved.

(d) Dairies, refrigerator plants, bakeries, plants for the manufacture of necessary medicinal products, water works, sewerage plants, printing plants for the printing of newspapers only, battery charging outfits in connection with plants producing light or power for telephone, telegraph or public utility companies are exempted.

HEAT FROM BITUMINOUS COAL AND COKE.

1. Only enough heat may be used in offices, stores, warehouses and manufacturing plants to keep the average temperature at 68 deg. Fahrenheit, and then only during the hours for which light is permitted. During other hours only enough heat is to be used to prevent freezing of water pipes or sprinkler systems.

2. In manufacturing plants or plants coming under power curtailment rules, heat (to 68 deg. Fahrenheit) will be allowed only during that time prescribed for use of power.

POWER FROM BITUMINOUS COAL AND COKE

1. No manufacturing plant or factory shall be furnished bituminous coal or coke, or heat, light or power from bituminous coal or coke furnished by or through the United States Fuel Administration for operation in excess of three days a week on the basis of present working hours.

Exceptions:

Dairies, refrigerating plants, bakeries, plants for the manufacture of necessary food products, of necessary medicinal products, water works, sewerage plants, printing plants for the printing of newspapers only, battery charging outfits in connection with plants producing light or power for telephone, telegraph or public utility companies are exempted.

2. Elevator service must be curtailed as much as possible in accordance with above regulations on use of heat, light and power.

ELECTRIC RAILWAYS

1. Electric railways shall reduce schedules to minimum requirements of service under revised hours of heating, lighting and power as herein provided.

2. No heat shall be provided on electric cars during rush hours and heating during non-rush hours shall be curtailed as much as possible.

GENERAL

1. Electric railways and manufacturing plants, stores and offices shall co-operate in arranging, within the provisions of this order, schedules, days and hours of work to permit the maximum utilization of transportation equipment."

Distribution of the Railway Dollar

ONE OF THE MOST striking features of the annual report of the Bureau of Railway News and Statistics for the year ended December 31, 1918, is the diagrams on the back cover of the report showing the distribution of the railway dollar in 1918 and in 1916. According to these diagrams, the railway dollar was distributed in these two years as follows:

	Where it went to in 1918	in 1916
Labor	54.06	40.60
Fuel and locomotive supplies	11.11	7.45
Material and supplies	14.40	15.77
Loss and damages	2.02	1.67
Taxes	3.87	4.46
Total expenses	85.46	69.95
Interest	8.74	12.48
Rent of leased lines	2.59	3.96
Betterments .....	.56	1.83
Available for dividends, reserves and surplus	2.65	11.78
Total	100.00	100.00
For deficits		

Commenting on this, the report says that "Experience has shown that when the expenses and taxes of American railways as a whole exceed 70 per cent of their revenues many roads are in distress and more lack credit."

It will be perceived that for the year 1916, when the operating income of all the roads was \$1,105,106,214, the operating expenses were only .05 per cent within the zone of safety. It is this fact that makes the comparison of the diagram especially valuable. A similar diagram for the calendar year 1917 showed that the operating expenses had crossed the line of safety into the zone of danger to the extent of 6.15 degrees. In 1918 the margin of safety was left 15.46 per cent in the rear.

The first nine months of 1919 show that there has been no halt in the march of expenses into the territory abounding in deficits, defaults and receiverships, from which the taxing power of the United States alone saves its railways today. The other means to save the situation—the power to raise the rates to yield sufficient revenues—the government has so far declined to adopt.

Another figure in the diagram for 1918 commands attention—the 54.06 per cent of gross revenues paid to labor against only 40.60 per cent in 1916. Practically the entire increase in expenses is accounted for here by the increase in the percentage distributed to employees. Moreover, this 54.06 per cent is computed on the largest operating revenues in the history of American railways.

The aggregate compensation of railway employees in 1918 was \$2,686,734,498, or nearly \$300,000,000 more than the total operating revenues in 1908! The average pay of 1,897,741 railway employees in 1918 was \$1,416 a year and the average per day was \$4.52 against only \$2.25 in 1908, an increase of over 100 per cent in ten years. These figures do not include the administration's pay roll, which numbers 2,500 persons whose average pay is \$2,567 per year; or the 2,619 officers and employees of the corporate organizations whose pay averaged \$2,147 per year. These last figures are interesting as affording a comparison between the pay of the officials dismissed by the director general and of those appointed in their places.

Another revelation contained in this report is the enormous increase shown in the pay of clerks from \$120,766,765 in 1915 to \$263,657,074 in 1918. The class of clerks receiving less than \$900 per annum, of whom there were 101,751 in 1917, has been practically eliminated. Where this branch of the service accounted for a total of only 1.9 per cent of the operating expenses in 1907, in 1918 it amounted to 6.2 per cent.

The report covers 250,473 miles of operated line and presents the first complete review of the railways of the United States for the first year of government operation.

The Signal Engineers' December Meeting

Signal Division Holds Large Meeting in New York—Standards Discussed—Plan Next Annual Meeting

THE FOURTH MEETING of the Signal Division, Engineering Section, American Railroad Association, was held at the McAlpin Hotel, New York, on December 2 and 3. As a result of the recent letter ballot, the times of holding the meetings were changed to March and December for the stated meetings, with the annual meeting in July. A tabulation of the vote shows that 338 voted for the change and 105 against. The change was proposed so that all reports could be sent to the executive committee of the American Railroad Association, by October 15, but there is still some dissatisfaction.

The attendance at this meeting was very good—140 active and affiliated railroad members, 2 junior and 89 associate and affiliated non-railroad members, with 19 guests, a total of 250. The meeting was presided over by the chairman of the Division, C. J. Kelloway (A. C. L.). Secretary H. S. Balliet (N. Y. C.), deferred the reading of the minutes of the September meeting, as because of the printers' strike in New York, they had not been printed.

The first discussion was that on the report of Committee No. 3, power interlocking, F. B. Wiegand (N. Y. C.), chairman. This committee presented a specification for universal electric locks for hand operated switches, first and second range voltage; and a specification for an electric lock for power interlocking machines. Both were presented only for discussion, not for final adoption. Mr. Wiegand, in presenting the report, gave an abstract of information received from the Bureau of Standards, Washington, relating to proposed action by the Bureau looking to revision of the publication containing national standards of screw threads.

The discussion was participated in by Messrs. W. H. Elliott (N. Y. C.), P. E. Carter (G. R. S.), B. H. Mann (M. P.), J. C. Mock (M. C.), A. H. Rudd (Penn.), and F. L. Dodgson (G. R. S.). Questions as to the height at which a switch box shall be placed, whether indicators should or should not have doors, and as to the advisability of having contacts on locks for power interlocking machines were considered. Mr. Mock spoke of the need of improvement in arranging apparatus on power machines; there is a tendency to put too much on these machines; he has taken off such things as polarized relays and placed them in separate places, a change which was found to facilitate proper maintenance. As to locks on these machines, it was the sense of the meeting that they should have no contacts.

Committee No. 5, on maintenance rules and instructions, L. R. Mann (M. P.), chairman, presented a code of questions and answers for an examination paper for signal maintainers. This fills a dozen pages of the program issued for the meeting and was discussed at considerable length. These questions and answers were presented only as information and the dozen or more members offering criticisms dealt only with minor details. It appears that some of the things which, in this document would be required of maintainers, are forbidden by the agreement between the railroads and the maintainers as recently drawn up by the United States Railroad Administration. Another significant suggestion was that some of the clauses referring to flagging would seem to forbid a maintainer to stop a train in case of danger.

Standard Designs

Committee No. 6 submitted for approval six drawings containing standard designs, and a seventh, a base for a 4-in. mast, for discussion only, the report being presented by

J. C. Mock (Michigan Central), vice-chairman. The first drawing, No. 1010, crank and jaw pins, was adopted without discussion. This and the next two are former standards revised in a few details. No. 1015, one-inch signal pipe, was adopted after brief discussion. The committee had changed the rivet holes; a member proposed that the rivet be made one-sixteenth inch smaller. This the committee promised to consider. One member wanted the plug to be made a tighter fit, but this view did not prevail. The drawing was adopted subject to possible change as to the length of rivet. Drawing No. 1220, crossarm bolts, was adopted. The list of standard cotter pins, drawing No. 1409, was adopted without discussion.

Drawing No. 1430, a semaphore lamp with two lenses, facing in opposite directions, was the subject of considerable discussion. Mr. Ralph (Northern Pacific) proposed the placing of a mark on the inside of the lamp, opposite the peep hole, to simplify the work of the instructor who has to tell illiterate men how to adjust the height of the flame. The casting shown in the drawing is designed for a backlight and a peep hole, both in one casting, although both of these holes may not be called for in all lamps; the object being to reduce the number of standard castings required. This explanation answered some inquiries as to the arrangement of the holes. W. H. Elliott, New York Central, believes backlights no longer necessary.

Mr. Beck (N. Y. C.) objected to the adoption of a standard for a two-lens lamp as such a lamp gives satisfactory service only where the line of road is straight; but to this Mr. Ralph replied that on his road a lamp made by Adams & Westlake was used with satisfaction, in which one of the lenses is adjustable for curved track. Criticism being made of the outer hood surrounding the lens in this drawing, which does not extend out quite so far as the bullseye, Mr. Mock said the committee would consider the adoption of a deeper hood; and the drawing was accepted.

Drawing No. 1449, a base for a four-inch iron mast, was explained by Mr. Mock as having been made for the purpose of providing for heavy highway crossing signals a stronger post than that usually used, while yet not so heavy as the standard semaphore post. This drawing was submitted for discussion only.

Drawing No. 101 A. R. E. A., a 16 ft. 6 in. split switch, was presented by the committee for the purpose of showing the location of the holes drilled in the switch points; after brief discussion this arrangement of drilling was adopted.

Committee No. 11, batteries, R. B. Elsworth, chairman, presented revised standard drawing No. 1224 showing a storage battery jar, cover, sand trays, etc. A few details have been added. The changes have been commended by the manufacturers, and after a brief discussion the drawing was adopted for submission to letter ballot and inclusion in the Manual. The committee submitted a specification for type A, caustic soda primary cells and renewals. Mr. Elsworth said that this had been fully discussed with the manufacturers and, except section 6, it was quickly approved. That section, prescribing the required capacity of a battery, was discussed at some length. Section 6 deals with the capacity of batteries but does not indicate the maximum capacity nor does it describe the method of making a test, the battery makers having been unable to agree on a recommendation to the committee.

There was some discussion of the question whether

primary batteries should be used for low-voltage switch machines; but Mr. Siebert, Mr. Rainey, and others said that they were using these primary batteries successfully, using two sets in multiple. Mr. Siebert's low-voltage machines operate in 30 seconds. E. W. Kolb (B. R. & P.), reporting on results brought out in his laboratory for testing primary batteries, suggested in detail a complete revision of section 6 defining capacities.

There was some discussion over the desirability of a clause in the specification providing for jars of rectangular shape. There was considerable sentiment in favor of this shape. Mr. Kelloway had found that 14 cells and 5 cells for track circuits, by using this shape, could be installed without making special provision for housing.

Committee No. 13, P. M. Gault, chairman, presented a specification for ranges and scales for voltmeters for alternating current, which was briefly discussed.

Committee No. 2, on mechanical interlocking, Samuel Miskelly, chairman, presented a specification for mechanical interlocking machine, style "A" locking. This was discussed very briefly and the meeting then turned to the specification for lever locking for mechanical machines presented by the same committee for inclusion in the Manual. It was argued that this matter should be combined with the specification for the machine, paragraph 6, but to this it was answered that considerable reprinting could be saved by keeping material concerning lever locking separate.

A discussion then arose as to whether specifications presented at a stated meeting could be acted upon by letter ballot. The rules allow this but there was doubt concerning the advisability of submitting to letter ballot specifications and other matter which has been discussed at only one meeting. It appeared to be the sense of the meeting that there should be discussion at two meetings so that all parts of the country would be more fully represented. Mr. Elliott moved that the mechanical machine lever locking be accepted for presentation at the annual meeting, and it was so voted.

Committee No. 7 on direct current relays, E. G. Stradling, chairman, presented a specification for lifting armature direct current relays, which was briefly discussed. The committee had made a number of modifications since the report was presented at Atlantic City last June. A few further changes were suggested.

Committee No. 10 on signaling practice, J. A. Peabody, chairman, presented a brief report on methods of control to cause signals to indicate stop in emergencies, giving a condensation of information received from a number of railroads replying to a circular. The committee had sent out 36 circulars and received useful information from ten roads. The Western Maryland and the Illinois Central have arrangements for opening track relay connections and also have knife switches. The New York Central uses knife switches and also arrangements for conveniently cutting by pliers. The Union Pacific opens the signal circuit wire by a knife switch or breaks the track circuit by knife switch. The Norfolk & Western shunts the track circuit by knife switch. On the Louisville & Nashville and the Chicago, Rock Island & Pacific, special indicators are provided for the information of signal maintainers. On the Northern Pacific track circuits are shunted by a controller operated by hand.

The committee recommends that for temporary protection the maintainers should be instructed to disconnect the signal circuits. Where a permanent arrangement is desired it may be provided by: (A) Opening track relay through knife switch. (B) Opening circuit wires through circuit controllers. (C) Shunting track by circuit controller or knife switch. Indicators may be provided to advise track workers of the approach of trains.

In the discussion the use of shunt wires was criticized as unreliable, especially in the hands of trackmen and others unskilled, but it was pointed out that sometimes a good deal

of time can be saved by their use, as it may take a good while for a track walker to reach a relay box. If the track watchman can be depended upon to report dangerous conditions he ought to be competent to manage a shunt wire.

Valuation Work Done by the Government

Committee No. 15, J. M. Carley, chairman, presented a report detailing some of the methods employed by the Interstate Commerce Commission in its work of valuation of railroad property. This report was discussed briefly by C. H. Morrison (N. Y., N. H. & H.), T. E. Beck (N. Y. C.), G. K. Thomas (A., T. & S. F.) and K. E. Kellenberger, associate editor of the *Railway Age*. Whether or not functional depreciation should or should not be considered was the main topic under discussion.

Lubricating Oils

Committee No. 16, I. S. Raymer, chairman, presented a specification for zero lubricating oil and one for 45 degrees below zero lubricating oil. It was proposed, and the committee will consider the naming of the different kinds of oils by numbers so as to provide short names which will be distinctive and can be readily remembered. There was a long discussion on what elements should be included in describing zero oil. Because of the great demand for oil at the present time, and the consequent impracticability of always securing oil from the same field, there is a good deal of variation in quality, and oil frequently fails to behave as well in service as it does in the laboratory; but the only remedy mentioned for this condition was to get the aid of the signal manufacturer in securing satisfactory oil.

The last paragraph of each specification calls for clean, dry containers as specified by the purchaser, and in discussing this paragraph there was a demand that the committee recommend standard sizes of containers, one as small as one-half pint. No action was taken. Both of these oil specifications were accepted for submission to letter ballot with a view to including them in the Manual, but the motion evidently was adopted with the tacit understanding that changes would be made by the committee and that final disposition would be made at the annual meeting.

Committee No. 4, on D. C. automatic block signaling, C. F. Stoltz, chairman, presented for discussion a specification for universal switch circuit controllers. In the clause relating to ventilation, the committee accepted a suggestion that caps might be put on the inside of the case; also that binding posts should be prescribed of larger size. Mr. Elliott, New York Central, has used for several years binding posts 5/16-inch in diameter and finds them satisfactory. A large size is necessary to withstand the jarring to which these boxes are subject. A member called attention to the absence of any clause requiring an inside cover for the operating cams, but the committee replied that this point was omitted because on so many roads it is the practice to have no such inside cover.

The specification was accepted to be referred to the annual meeting with a view to having it referred to letter ballot and inclusion in the Manual.

Annual Meeting

At the close of the meeting, Secretary H. S. Balliet announced that the next meeting of the Division would be held in Chicago on March 16, next, and the annual meeting at Thousand Islands Hotel, Alexandria Bay, N. Y., on July 14, 15 and 16, 1920. It is intended to arrange for the reservation of rooms at the hotel by the secretary of the division, Grand Central Terminal, New York City, early in June. He and the secretary of the Signal Appliance Association will co-operate in this matter. In view of the probability of a large attendance, arrangements are being made with two other hotels within 500 feet of the Thousand Islands house.

Concerning the Utilization of Freight Cars*

Obligations of the Carrier and of the Shipper—Need of Co-operation—Car Pools

By W. C. Kendall,

Manager of the Car Service Section, Division of Operation, United States Railroad Administration

THE STEAM RAILROAD is now nearly 90 years old. The units used for transportation are still in process of development and new questions arise year by year. I am posing neither as a reformer nor a critic; but I do believe that we are just now at a period when we must take heed as to whither we are drifting.

Freight cars now number about 2,500,000 and to replace one will cost at present prices close to \$3,000. In what other business can you find an article of such value literally turned loose for your use and mine? I firmly believe the experiences of the recent past have demonstrated beyond peradventure the complete interdependence of the railroad and shipping public. The railroad has found that it can no longer act in its own interest, but that the public will find a way to demand a reasonable share of consideration. The shipper has found that there are problems other than his own which must be considered. There must be some measure of give and take. Our real progress must be measured by the friendly spirit of understanding and co-operation which has grown up between those who have the commodity of transportation to sell and those who purchase. In probably no other commercial transaction does the one party have so much to say as to the fairness or otherwise of the other, either in fixing the price of the commodity which is for sale, or the value of the trade to the purchaser.

The Obligation of the Railroad

We have a country which spreads 3,000 miles in one direction and 1,500 to 2,000 miles in the other, within which area we have a public with a widely varying opinion. The coal shipper of Pennsylvania—or possibly I should say the consignee—is, relatively speaking, of a different opinion as to the type of coal car which is best adapted for his business, from that held in Missouri. One shipper of lumber demands open cars for the convenience of loading and assumes the expense of staking, while another shipper of the same kind of lumber demands a closed car to save the expense of staking, disregarding the inconveniences and increased cost of unloading. A shipper of early vegetables in one section of the country may feel that the market available to him will be better served if his product is moved under ventilation, while another shipper of the same commodity will demand refrigeration for the same distance and perhaps in the same general territory. We have constantly an exacting, and if I may be permitted to say it, finicky public to be served.

We must try to please when and as we can, sacrificing somewhat where necessary. Shippers have been generous in using unsuitable cars and in other patriotic acts, often to their loss, carriers have given some poor service, but it is to be borne in mind that in response to the demands of war time production the wheels have almost literally been run off the cars. There has not until the past six or eight months, been opportunity to stop the cars long enough for overhauling; but covering the dissipated repair forces which were so largely upset by war no effort or expense is being spared to properly and promptly condition the cars now awaiting repairs.

A road under-equipped is not doing its duty to the public. Generally, a railroad owns sufficient cars to market the com-

modities produced on it, but there are varied circumstances. The coal loading road has, as a rule, provided cars in sufficient quantity to carry the product of its road to destination, irrespective of whether that destination is on its rails or not. This has required a heavy outlay entirely inconsistent with purely local requirements. On the other hand, a road may be a heavy receiver of box car freight and originate little or nothing; such a road may not reasonably be expected to provide box cars for it would never succeed, except in times of serious car shortage, in getting these cars into service. Another line may be a heavy producer of perishable fruits and require large quantities of refrigerator cars. The movements may be over two or three intermediate lines which may not reasonably be expected to contribute refrigerator cars for this through movement. This question must be studied in all its variations and some formula arrived at which shall properly and equitably distribute the burden of ownership among all lines. This is not an easy question, but is one to which a competent committee, duly authorized, concentrating for a few weeks, could find the answer. By such an arrangement the roads altogether might be saved a capital expenditure approaching \$300,000,000 (100,000 cars).

Service

Terminal and divisional yards must be so policed that cars may not get caught and held. In spite of such action as has been taken to correct delays in yards, I have never seen anything really effective except a record which will work automatically and force those responsible to immediate action. The individual card record can doubtless be adapted to this purpose, and is the nearest proof against error I have ever seen. While the clerical expense involved may be increased somewhat, it is but little comparatively speaking and is as nothing when measured against the possibility of saving in car days.

The shipper cares not so much for quick movement as he does for regularity and dependability. Fast service has been advertised and practically all of the special attention given has been concentrated on these particular trains while the remainder of the traffic, probably comprising 90 per cent of the whole, has been given no special thought. The public generally will be better served if the supervision is spread equitably over all freight movements. We probably lack supervision. Its first cost is expensive; but we must devise some means, automatic or otherwise, which will enable us to check our overdue movement.

Car Distribution

When a car shortage prevails the railroad must determine an equitable basis upon which cars may be divided between shippers and between commodities. Certain obligations must be met and the question of preferential treatment must not interfere. In the first place, freight houses must be kept open. This is a public necessity. All the cars required to move l.c.l. freight to other towns, must be furnished. Certain commodities such as newsprint paper must be provided for. The question of distribution gives a railroad much concern lest it be accused of discrimination.

The distribution of cars for coal and grain is on a well-established and equitable basis. It might be possible to do

*Abstract of an address delivered before the New York Railroad Club, October 17, 1919.

as well with lumber. I doubt the practicability of giving a mathematical rating to all shippers. Fair treatment of shippers, as between commodities and between stations, and between individual shippers is an element to which the railroads must give further attention, arriving at some well established and acceptable basis.

The Obligation of the Shipping Public

The average railroad official is ready to admit shortcomings and to assume his share of the burdens, but there are well-defined obligations resting upon the shipper and consignee: (1) prompt loading and unloading; (2) capacity loading of cars; (3) proper use of the reconsignment privilege. The shipper is frequently careless, not conforming his orders for cars to his actual daily requirements, he is not apt to be considerate as to specific type and capacity. The shipper should order cars in writing and well ahead of requirements; and be precise as to ability to load. Under our present system we have many cases of duplication and inflation which are misleading with a consequent derogatory effect on the car supply in general.

Some hold that demurrage is a device of the devil, designed to extract money from the unsuspecting and innocent, others that the demurrage rules are built for their benefit, to give them certain rights with property not their own, to be exercised without limit; neither position is correct. Demurrage is by necessity a punitive measure to protect one against another's neglect. [Here the speaker made a strong appeal for concentration of effort with respect to prompt loading and unloading. He finds that even after a consignee has been to considerable trouble in speeding up the unloading of his car the railroad sometimes fails in its obligation to move the car with corresponding promptness.]

Our Car Service Section records show that on a certain date 1,922 consignees on 158 railroads were holding 7,764 cars under load, an average of 3 days each *beyond* the free time, or a total of 5 days per car. This represents a total of 23,292 car days beyond the free time which divided by 16 days—an assumed average turning time of a coal car—represents the equivalent of 1,456 cars continuously tied up.

Capacity Loading

During the railroads' campaign of 1917 when all were fired with patriotism, the average loading of cars was increased by something over two tons a car, a gain of from 10 to 16 per cent. If in the flight of your imagination you consider the 250 billion ton miles already recorded as moved by the railroads under federal control for the first eight months of this calendar year, and equate the loss of 3 tons per car which is the figure for August, you will find a possible theoretical saving of something in excess of 200,000 cars for daily use. That is, instead of having 2,250,000 cars available for service daily we should have the equivalent of close to 2,500,000. In August our ton miles decreased 10.8 per cent while our loaded car miles decreased but 2.9 per cent, which gives a picture of the loss of car efficiency due to light loading. We must study the possibilities as between commodities, and the effect of minimum weights. The possibilities of double and triple loading are daily before us. One car can be made to do the work of two in moving salt, sugar, flour, feeds, etc., a saving which is of tremendous importance. Money invested in supervision of this element of transportation will return a hundred fold. Eternal vigilance is the only way.

Reconsignment

Reconsignment is a reasonable and a legitimate traffic privilege but it is subject to abuses. The broker who deals in bills of lading and has no established place of business is a parasite on the railroads; he is on a very questionable basis. There are those who send shipments from one market to another, taking chances on possible sales; and they will recon-

sign again and again, possibly with the object in view of dodging demurrage charges. Meantime the car is kept under load and out of the service to which it belongs. Who has not seen that sale list of a hundred or more cars of lumber "on wheels" and each with its little code word? Why, we all know that at least half of those cars do not exist!

These then are some of the more important elements of transportation in which the public has a direct responsibility toward improvement. I am sure I cannot be accused of undue bias in making the statement that none of these things represent as much actual effort or expense as do those factors for which the railroad is responsible. Supervision is the answer. But it is impossible for the railroads to have officials responsible for every little thing, with eyes and ears spread over the last inch of 200,000 miles of line, and the railroad and the shipper should sit down together, in a spirit of helpfulness, and see that the tag ends existing here and there are caught up according to the best judgment and conscience of the individual. I do not believe that corporations have no souls, for I have abiding faith in the conscience of the individual railroad official.

Advanced Movements

It is to the interest of all, economically speaking, that the traffic movements be spread as evenly as possible throughout the year. Some commodities do not lend themselves readily to this practice. Melons, peaches and grapes will not wait for transportation; transportation must wait on them. Fertilizer must move generally according to the whim of the farmer; he does not want to tie up his money and cannot store this commodity in advance of requirement. To find adjustment as between seasonal or semi-seasonal commodities and the general run of traffic presents an opportunity for the shipper, the consignee and the railroad to get together in real helpfulness. Such commodities as pulpwood and clay for the paper mills; phosphate rock for the fertilizer plants; the winter's stock of bituminous and anthracite; wood for the chemical plants; should be moved when tracks are not crowded, and placed in storage. The phosphate rock mines of Florida have been practically idle for the past six or seven months, but the commodities necessary for next season's fertilizers are not yet moved and they must be moved between now and February 1, our period of heaviest movement and most difficult operation. For the calendar year up to July 1 the bituminous coal production averaged about 8,500,000 tons a week with literally thousands of coal cars idle. Now, in response to vigorous demands of the public, we are hitting 11,500,000 tons weekly, which represents an increased transportation requirement of over 35 per cent for this commodity alone, accompanied by a shortage of cars for this and other commodities, and also a bit of hysteria. Here is presented real opportunity for exercise of the principle of community of interest.

Market Conditions

An established market is helpful to the railroads. It prevents a tendency to panicky conditions among shippers and creates a spread of transportation which is helpful. A shortage in the potato market at New York will send the quotations up and the Maine farmer will call for cars instantly. The warehousemen are all in the same state of mind, desiring to catch a sale on that market, and orders for cars for potatoes jump from zero to hundreds overnight, presenting to the railroads an impossible task. Suppose cars were supplied to fill all the potato orders; the shipments would then be so heavy that the market would break and the producer would immediately cease shipping. . . . There is a considerable tendency to traffic in wheat and other grains already on wheels which ties up cars and which a stabilized market would help to correct. To some extent a similar situation exists with respect to the lumber traffic. Possibly there are certain advantages in having live stock arrive at the large markets on

Monday or Tuesday, but what a saving would follow if shipments of livestock were spread through four or five days of the week! Car supply would be stabilized and train runs would be adjusted to a more even basis.

I appreciate that we cannot interfere with the inexorable law of supply and demand, but nevertheless there would seem to be presented an opportunity for movements such as these to be stabilized; perhaps through association membership which will voluntarily give control to some of these elements without in any way jeopardizing the interests of the industry or the individual.

Shipping Day Plan

The "shipping day plan" has not gained the popularity which I believe it deserves. No doubt the shipping public feel they have exercised all the patience as to the practice of this idea which can be expected. It must be borne in mind that it was presented at a time when railroads were struggling with a shortage of experienced labor, also that available labor was somewhat short of experience. Furthermore, there was not full cooperation among all railroads. But it was a bit of pioneering which should have a stronger support. The theory is excellent; it is not fool proof; it needs help and not so much suspicion that the railroad is trying to put something over.

Permits and Embargoes

In some instances of abnormally rapid development of industries a quite impossible burden is imposed on the railroad. War-time Bridgeport (Conn.) and the oil craze at Burkburnett, Tex., are instances of what I mean. Probably the development of the Texas oil fields represents the most rapid growth of railroad requirements of any period in our history. * * * But for reasons of his own the consignee does not release cars promptly. He clogs the ways. He falls behind for perhaps perfectly legitimate reasons. The embargo is then necessary. This creates a wave-like line of transportation. The permit plan of handling traffic strictly on a basis of ability to dispose of at destination becomes necessary. It creates a "delinquent" list which is quite psychological in its effect. Generally speaking the public are favorable to the permit system, for with it goes a sense of realization of its benefits. Wherever there is opposition I feel railroads must ask the public to be patient in its operation, as I am convinced that in no other way can the traffic of this country be at all times satisfactorily handled. The system has fully justified itself.

Propaganda

A certain industry anticipating a possible car shortage—it positively had not arrived—apparently communicated with all of its branch offices and correspondents in various states and definitely suggested that the question be brought to the attention of the powers that be through senators and congressmen. As a result we had complaints from practically every state in the Union, all as to a single situation at one loading station. We were in receipt of seven letters from the people's representatives of one state with enclosures which read identically the same. Propaganda of a different sort comes indirectly from newspapers and newsprint mills. If there is a temporary car shortage at a paper mill there is likely no preference as to whose paper shall have priority of movement so all newspapers are notified that *their* paper cannot be shipped and to get busy. There is relatively no storage of newsprint at points of consumption. We then hear of it from widely separated sources. There is only a certain quantity of cars for distribution and innumerable telegrams and letters cannot increase this quantity. To give preference where no preference is due will involve unjust dealing. Much time and energy would be saved for more important matters with a policy of direct dealing.

Car Service Rules

One of the most important questions before us today, and one in which the public will claim a vital interest, is whether we shall follow the rules observing the ownership of the car or consider all cars common railroad property and load them accordingly. In the fall of 1916 the demands for cars became so urgent that there was a tendency for every road to grab all available equipment and appropriate it to its own uses regardless of rules or obligations. The result was that the cars gravitated naturally into those areas where the industrial activity was the greatest; and not only did they gravitate to these regions but they stayed there, making a corresponding shortage in the producing sections. Then penalties were provided to force the cars home. In the following spring and after various experiments with a strict ownership plan, the war pressure became so urgent that the lid was off; it was "catch as catch can"; and a common-use plan for box cars was authorized with a forced relocation of empties as occasion might demand. In the fall and early winter of that year the situation became so acute in the industrial centers that in the interests of greater production of coal and easier operation a limited coal car pool was authorized. Both of these situations exist today and they present a somewhat complicated situation.

This brings to the fore, as the time approaches for the return of the roads to private control, the question of right or opinion as between the two schools of thought—the adherents of the ownership plan on the one side and those of the pool on the other. Probably the answer lies somewhere between the two. It probably will be conceded, based on the experience and practice of the past two years that with an ownership plan in operation there must be more flexibility than was had in the past. On the other hand, if a modified plan of common use is authorized some protection must be given the owner. Each railroad executive will probably insist that this money was expended for a certain type of car particularly adapted for the shippers and receivers on his lines. Then, too, there is a general pride of ownership which, from a psychological point of view, is important. The consensus of opinion among the lesser operating officials, and this is meant to also include the yard forces, is probably favorable to the flexibility of the common-use plan, for it gives them an opportunity to respond to the demands of their superiors for decreased operating expenses and is a very considerable factor. Thus we have the railroad family somewhat divided on this question.

The shipper is not particularly concerned as to whose car he may be using. What he asks for is a unit of a type to suit his needs—box, coal, flat, stock or refrigerator—which is in good condition and which he can load to whatever destination he chooses. If his car is not forthcoming as he has ordered it he is not at all concerned as to the marks which may be on the side of a car already in his possession. The privileges which have been extended to the shipping public the past two years with respect to the common use of cars have served to form habits which may not be easily broken. As shortages occur the shipper will demand a car without respect to any railroad rules which in his judgment deprive him of something to which he believes himself entitled. If it were possible to standardize cars overnight the problem would be easier. Standardization of equipment does not seem near at hand, although progress has been made for years; but in the nature of things standards must change as ideas develop. Great progress has been made during federal control in the way of standard types of cars and locomotives. Purchases of these standards are however but a small proportion of the whole in point of numbers. Inasmuch as the life of a car will probably average 20 years the period within which standardization can be fully accomplished is thus seen to be a very indefinite one.

I do not think that with a concentrated effort the proposi-

tion will prove an impossible one to deal with. Merely as a suggestion I believe that if ten railway presidents, ten operating executives, ten mechanical superintendents, ten transportation superintendents and ten yardmasters, all selected so as to cover a wide geographical distribution, were to assemble in committee, guaranteed the privilege of free speech and protection from the consequences thereof, and with full authority to act, in two or three days' time they would develop principles which could form the basis for a smaller committee to frame a code or an understanding under which all roads could handle cars to the best advantages and maintain them to the highest possible standards. Like every other move toward real progress this involves the good faith of the individual and, what is all-important, sufficient and efficient supervision.

There are probably car units enough in this country to handle present production. The freight equipment must however be so kept in repair that only a reasonable number of cars shall be out of service; and shipper, consignee and railroad must each do their part in conserving time and avoiding wasteful practices. For the present we should promptly replace all dismantled units, car for car, but of modern capacity. It is not altogether a lack of cars which accounts for our shortages; it is lack of utilization. Show me the actual number of cars short and I think I can show you where there are cars which are or can be made available if we will all fulfill our obligations.

Converting Cross Compound Locomotives to Simple

DURING THE YEARS 1905 and 1906 the Minneapolis, St. Paul & Sault Sainte Marie purchased considerable number of cross-compound locomotives of the Consolidation type. These engines were among the heaviest of their class at the time they were built, the total weight in working order being 101 tons. At the present time they are still used in through freight service, and in order to eliminate the unsatisfactory features of the compound, one of the class was recently converted into a simple locomotive, using superheated steam. Tests conducted to determine the relative fuel consumption of the compound and the simple superheated engine showed that the change resulted in a substantial saving of fuel.

For the purpose of the test two engines were chosen, which were in practically the same mechanical condition. Engine 448 was a cross-compound, while engine 468 was superheated with simple cylinders. One engine crew was assigned to the test and was used on all the runs. In order to obtain a close check on the fuel used, approximately the correct amount of coal for the run was weighed and put into the coal space of the tender. An additional supply was weighed out into 100 lb. sacks and was carried on the back of the tender. The fuel used in firing up and before the test started was taken from the sacks and accounted for separately. After the main supply had been burned sacked coal was used, or in case the pit was not emptied the remainder was removed and weighed. A record of the water used was made each time the tank was filled.

The division on which the test trains were run extends from Moose Lake to Boylston Junction, Minn., a distance of 38 miles. The regular tonnage for the cross-compound locomotives is 90 cars, or 1,440 tons, and the majority of the trips were made with this tonnage. On two trips with the superheated simple engine the train was increased to 100 cars of 1,600 tons. Although the increase in the rated tractive effort of the simple over the cross-compound is only six per cent, these runs showed that engine 468 would handle

100 cars better than engine 448 would handle only 90 cars.

On hauls out of the ore mines the regular rating for the compounds is 50 cars, but on test trips engine 468 handled 55, 59 and 60 cars without any difficulty. Another trial run was made from Superior to Glenwood, Minn., a distance of 200 miles. On this division the tonnage rating for the cross-compound engine is 2,200 tons, but in order to make the trip in less than 16 hours the train must be reduced to from 1,800 to 2,000 tons. With engine 468 a train of 2,157 tons was hauled from Superior to Glenwood in 10 hrs. 7 min. actual running time.

The fuel performance with the two engines on the trips between Boylston Junction and Moose Lake is summarized in the accompanying table:

Engine number	Test number	Number of cars	Ton- nage	Coal per 1,000 ton miles	Coal De- crease per sq. ft. of grate	Engine per cent	Actual evap. per lb. coal	Running time
468	1 and 2	90	1,440	124	13.9	78.0	6.93	1 hr. 42 min.
448	5 and 6	90	1,440	144	....	56.5	7.78	2 hr. 37 min.
468	3 and 4	100	1,600	128	....	80.0	6.96	1 hr. 52 min.

It will be noted that the actual evaporation per pound of coal with the superheated locomotive was 10.9 per cent less than with the saturated locomotive, due no doubt to the reduction in tube heating surface resulting from the application of the superheater. In spite of this the superheated engine used 13.9 per cent less coal per 1,000-ton miles.

The principal dimensions, weights and ratios for the original and the converted locomotive are given below:

General Data			
	Engine 448 (Cross compound)	Engine 468 Simple Super- heated	
Gage	4 ft. 8½ in.	4 ft. 8½ in.	
Service	Freight	Freight	
Fuel	Bit. coal	Bit. coal	
Tractive effort	37,300 lb.	39,500 lb.	
Weight in working order	201,500 lb.	197,800 lb.	
Weight on drivers	174,000 lb.	169,800 lb.	
Weight on leading truck	27,500 lb.	28,000 lb.	
Weight of engine and tender in working order	318,400 lb.	314,700 lb.	
Wheel base, driving	17 ft. 0 in.	17 ft. 0 in.	
Wheel base, total	25 ft. 11 in.	25 ft. 11 in.	
Wheel base, engine and tender	55 ft. 9½ in.	55 ft. 9½ in.	
Ratios			
Weight on drivers ÷ tractive effort	4.67	4.30	
Total weight ÷ tractive effort	5.40	5.01	
Tractive effort × diam. drivers ÷ equivalent heating surface	811.2	909.2	
Equivalent heating surface* ÷ grate area	61.8	58.4	
Firebox heating surface ÷ equivalent heating surface, per cent	5.45	5.77	
Weight on drivers ÷ equivalent heating surface*	60.1	62.0	
Total weight ÷ equivalent heating surface*	69.6	72.3	
Volume equivalent simple cylinders	11.45	.....
Volume both cylinders	15.65 cu. ft.	.....
Equivalent heating surface* ÷ vol. cylinders	252.8	174.9	
Grate area ÷ vol. cylinders	4.08	3.00	
Cylinders			
Kind	Cross-compound	Simple	
Diameter and stroke	23 in. & 35 in. by 34 in.	22½ in. by 34 in.	
Valves			
Kind	H.P. ton, cyl. slide	L.R. cyl. piston	
Diameter	6 in.	12 in.	
Greatest travel	6 in.	6 in.	
Wheels			
Driving, diameter over tires	63 in.	63 in.	
Driving, thickness of tires	3½ in.	3½ in.	
Boiler			
Style	Ext. wagon top	Ext. wagon top	
Working pressure	210 lb. per sq. in.	170 lb. per sq. in.	
Outside diameter of first ring	67¾ in.	67¾ in.	
Firebox, length and width	96¾ in. by 70¾ in.	96¾ in. by 70¾ in.	
Tubes, number and outside diameter	332-2 in.	28-5¾ in.	
Flues, number and outside diameter	15 ft. 9 in.	15 ft. 9 in.	
Tubes and flues, length	2739 sq. ft.	2089 sq. ft.	
Heating surface, tubes and flues	158 sq. ft.	158 sq. ft.	
Heating surface, firebox	2897 sq. ft.	2247 sq. ft.	
Heating surface, total	.....	327 sq. ft.	
Superheater heating surface	2897 sq. ft.	2737 sq. ft.	
Equivalent heating surface*	46.89 sq. ft.	46.89 sq. ft.	
Grate area	.....	.....

*Equivalent heating surface = total evaporative heating surface + 1.5 times the superheating surface.

Improving the Manufacture of Steel Rails

Several Practical Suggestions for Raising the Quality by Better Inspection and Mill Practice

By Robert W. Hunt

President, Robert W. Hunt & Co., Chicago.

FROM THE EARLIEST CONSIDERATION of the subject, the value of proper inspection has always been recognized, and some of the most important points of discussion have been as to how that inspection should be conducted. It has been the writer's fortune to have been connected with the manufacture of steel rails during the whole of the existence of that industry in America and therefore he has had, from practical contact, an intimate knowledge of the various developments that have taken place in that industry; and, particularly, as during the last 31 years he has made a specialty of steel-rail inspection, he feels that he may claim to have had the best of opportunities to become familiar with the details of the procedure.

This familiarity led him, early in 1912, to recommend to his clients a more detailed system of inspection than had until then been used, which should more thoroughly supervise the progressive steps in the manufacture of the rails; beginning at the making of the steel down through the various stages of manufacture to the loading of the finished rails upon the cars for shipment. On this line, the firm of Robert W. Hunt & Co. at the request of one and with the approval of several others of its more important patrons, established in 1912 what is known as its "Special Inspection." This consists in placing inspectors in all the departments of the steel works, beginning at the open-hearth furnaces or Bessemer converters, at the soaking pits and the blooming mill, the rail mill, the drop-testing machines, the hot beds, drilling and straightening departments, and, finally, the inspection of the finished rails. These men are placed at each of these several departments day and night, their duties being to observe carefully all the details taking place; and if there should be any deviation from the provisions of the specifications under which the rails were purchased, or deviations from the accepted practice of the mills, or abnormal conditions of any kind, to make note of the same; and while not at liberty to interfere directly with the workmen, to call the attention of the foreman of the particular department in which the occurrence is taking place to what is happening, and also to pass a written report to the inspector stationed in the next succeeding department, and so on to the finished-rail inspectors. The chief inspector is also required to give a written report of unsatisfactory conditions to the superintendent of the mill, so that there may be an absolute record of what has happened to each heat of steel made on either turn, be it day or night, and as the rails are stamped with their heat numbers, and location in the ingots from which they were rolled, the mill management will possess an individual history of each rail, with the possible identification of the individual workmen who were in control of the manipulation of the rail from beginning to end.

Moreover, a comprehensive report is rendered to the proper officer of the railway company for which the rails are manufactured, resulting in the archives of that railroad possessing a detailed history of the making of the rails. Hence, should a rail fail in service, it will be possible to not only have cognizance of all the details of its manufacture, but the makers will be able to determine the workmen who participated in that manufacture. As can be appreciated, this leads

to a personal responsibility being attached to every rail. It must be remembered that the workmen at the mills are paid by the ton, hence they are naturally desirous of producing as large an output as possible, and under the ordinary system of inspection, as soon as the rail left the works, all individual connection with it vanished, or, at best, any process of personal connection was extremely difficult and uncertain.

The result of this special system of inspection has been most satisfactory to both the manufacturers and the purchasers, and it receives the approbation of the workmen themselves, as each man knows that if he properly performs his duties he is protected against the danger of being held responsible for the acts of a less careful operative, while the mill management has given it, without cost, a thorough system of supervision. That it has proved satisfactory to the railway companies who have been employing it is best evidenced by the following, gathered from the records of the American Railway Engineering Association.

The statistics covering open-hearth steel rails give the failures that have occurred in five years, ending October 31, 1917, on 37,862 miles of track. Forty-five per cent of this mileage comprised rails rolled under special inspection, and therefore 55 per cent was made under other conditions. The total number of failures per hundred track miles on all of the mileage reported was 31.1, while the number of failures per hundred track miles on the rails covered by special inspection was 26.6, and the number of failures per hundred track miles of those not covered by special inspection was 34.8. Thus, there was 30 per cent in favor of specially inspected rails.

As each ingot is a separate and individual casting, I believe that, in addition to the tests representing the whole heat of metal, there should be some way of determining the physical character of the steel rolled from each and every ingot. As a destructive test seems to be the only way to actually ascertain that point, and as, of course, you cannot destroy all the rails, I, in 1915, installed what is known as the nick-and-break test, under which a test piece is cut from the top end of the first, or A, rail rolled from each ingot. This is nicked and broken, thus enabling the inspector to examine the fractures and, in case of the presence of segregation, pipe, or some other mechanical defect, to reject the rail represented by the test piece. Following such rejection, a test piece shall be cut from the bottom end of the same rail and broken; if that piece has similar defects, the second, or B, rail is rejected, and a piece cut from its lower end, and tested. In case of failure, the procedure is continued for the succeeding rails until a sound one has been reached. This has proved an expeditious and cheap procedure, and in my judgment very satisfactory.

A large tonnage of rails made under it is in American railway tracks and a much larger tonnage in those of Canadian railways. In fact, at the present time every standard steel rail rolled in Canada, and for all of that country's roads, is so made.

As the chemical composition of the steel is a fundamental part of rail specifications, a very important point is the taking, for analysis, of the drillings representing the heats of steel from which the rails are rolled. The drillings must

*A paper presented before the American Institute of Mining Engineers at a meeting in Chicago this week.

be taken from test ingots, and the time and manner of casting these ingots, as well as their shape, is receiving attention. In fact, the whole matter of ladle-test ingots is now receiving the attention and study of a committee of the American Society for Testing Materials in conjunction with the U. S. Bureau of Standards. Pending a full report on the subject by them, it would appear desirable to require the adoption of a standard sized and shaped ladle-test ingot and to insist that it be cast as sound as possible by the addition of aluminum to the molten steel; further, that two or three should be cast at equal intervals in a heat during the pouring of the large ingots and drillings from them carefully mixed. Thus, greater protection would be afforded as against a single small test ingot not representing, thoroughly, say, a 100-ton heat of steel.

All specifications should demand that the inspector representing the purchaser should have the right to witness the taking and mixing of the drillings, from which mixture, upon his request, he is given a portion for the purpose of check analysis. As a rule this is done, but at some plants it is a subject of dispute which should be prevented.

A few years ago there were many rail failures through what were designated as crescent-shaped breakages; that is, ruptures in the rail flanges extending from the outside inward toward the web, the broken pieces being of crescent shape. These fractures were frequently followed by complete cross-fractures of the rails, resulting in many costly and oftentimes fatal accidents. It was found that, as an almost inevitable rule, there was a longitudinal seam in the bottom of the rail flange at the point of fracture, which was directly under the web of the rail. This situation caused great anxiety and led to much discussion as to the causes of the seams or laps. One steel company developed and established a de-seaming adjunct to its rail mill, by which the outer steel of that part of the blooms subsequently forming the heads and flanges of the rails was milled off. The works claim success from the scheme. The later adopted sections have thicker flanges and the crescent-shaped breaking trouble seemed to have become minimized; but I regret to say that during the past year one of the prominent railway systems has been having a large number of such failures from heavy rails. Another system encountered the same kind of defects, which, in this case, fortunately were discovered before serious damage occurred. The rails were from different steel companies; therefore, it is again a matter demanding prompt and effective action. To require all producers to establish de-seaming mills is very radical, but if that is the only way property and life can be protected from such danger, it may have to be done.

Another point of less importance, but still of prime necessity, is the milling of both ends of the rails. This has been the practice of English mills for years and some American makers mill one end of some of the rails made by them. Depending on chipping and filing for the finishing of the ends of the rails is very unsatisfactory. Milling would not only eliminate all fins resulting from the hot sawing, but positively assure squareness of ends and accuracy of lengths, all three of which are of great importance in relation to joints, a part of track maintenance that is receiving more and more attention.

Much thought and considerable experiment have been given to the betterment of the cold straightening of rails. From the time of that procedure being represented by the blows of a heavy sledge swung by a sturdy man, the practice has been a brutal one. To accomplish the semblance of the desired result, the steel has to be bent beyond its elastic limit, thus enabling strains with an ever-present danger of causing actual or incipient ruptures in the metal, which may result in complete rail failures. In my judgment, it is practical to do away with cold straightening, by proper hot straightening of the rails. If, in case of uncontrollable

conditions, a few rails should come from the hot beds unsuitable for use, they could, after some cold straightening, be classed as seconds and used for other than main-track purposes.

In the present practice, a rail is put under the cold press and most carefully, but brutally, punched into seeming straight line and surface. Frequently, it is later put on the ties and with equal care spiked out of a straight line into curves of varying degrees. Rails can be hot straightened without any short kinks and with lines that will permit good loading for transportation and satisfactory track laying; thus can the expense and danger of the cold straightening be avoided. There are now at least a thousand tons of rails, finished as above advocated, giving satisfactory service in the lines of several railroads having heavy traffic, and they have had over three years of trial. The rail makers will welcome such a departure from present practice and, I am confident, make it successful.

To secure sound rails it is of supreme importance to make sound ingots. Sir Robert Hadfield presented a paper before the Iron and Steel Institute in October, 1912, which attracted wide attention and much discussion. The plan is broadly designated as using a "hot-top ingot," and many plans of obtaining such castings, other than directly following Sir Robert's, have been and are being employed successfully, notably on ingots to be used in ordnance work. As yet hot-top ingots are not used in rail making; both encouraging and disappointing experiments have been made, but I am satisfied that this method is practical and will be so proved. Based on the results obtained with other than rail ingots, its success with them is bound to come. Therefore, while I am not at this time prepared to incorporate hot-top ingots in rail specifications, the time is near when it will be entirely practical to do so. It may involve a somewhat greater first cost, to be at least partly offset by saving in scrap, but if the outlay is justified when making steel to be used in destroying life, should it not be even more so when producing metal on the soundness of which human safety will so largely depend?

The threatened shortage of high-grade manganiferous ores during the late war years led to economy in the use of metallic manganese, particularly through the more general adoption of the practice of adding it to the charges in a melted condition. The obtained results from a metallurgical point of view have been very satisfactory and specifications should insist on the practice.

The importance of the chemical composition of rail steel cannot be gainsaid. In former times, when acid Bessemer steel was used for rails, its composition was restricted to a large extent by the character of the original ores, it was controlled with considerable ease by the condition of the process itself. Heat after heat of fairly uniform composition was produced and, in short, the desired aim for the various ingredients of the steel was readily obtained. But basic open-hearth steel manufacture is fraught with far more difficulty, for, while the initial composition of the charge does not exert so much influence, the attainment of the desired composition for the heat is dependent on so many constantly varying conditions that a wider latitude in the range for some of the different elements must be provided. The time will come when this will not be necessary and the practice of using molten additions for recarburizing enables operations on a much more consistent basis with respect to furnishing steel of the analysis desired.

The most harmful physical characteristic of rail steel is, of course, brittleness. The low amount of phosphorus present in open-hearth steel renders protection against the dangers from that element and permits freer use of carbon as a hardening element. Experience has pretty well demonstrated that the safe upper limit for carbon in rail steel is approximately 0.75 per cent; and accepted practice has

allowed a working range of 13 points, with the result that the lower limit of carbon has been most frequently specified as 0.59 per cent, but in some cases 0.62 or 0.63 per cent; speaking, of course, of the almost universally accepted practice of having the steel contain not over 0.04 per cent phosphorus. The problem of always making basic open-hearth steel within this range is difficult and frequently heats are cast slightly outside the limits specified. There is a much greater commercial opportunity for manufacturers to find other than rail uses for steel containing the lower amounts of carbon than when containing the higher amounts; therefore, they naturally aim to have the carbon content nearer the low side of the permitted range. Hence, the larger percentage of heats is on the low side of the allowed carbon. In repeated cases, "off heats" are produced which fail to be within the prescribed limits of the particular specification to which the rails are being rolled, but are entirely applicable to another rail specification for which the mill has orders. This leads to the ingots from such heats being temporarily discarded, later to be re-heated and rolled on the other specification. This means re-heating and rolling of cold ingots, which is invariably accompanied by an increased production of second-quality rails, largely augmented by the lack of proper control and treatment in the soaking pits.

The various railway systems of the country are now using as their standard practice about the same weight of rails. There are some variations of sections, but I do not see any serious objection to the adoption of a general or common chemical specification. We know that hundredths of percentages are very delicate variations and, especially in relation to carbon, errors may occur in the results obtained by two different chemists, particularly if working under modern manufacturing pressure. If a common carbon, silicon, man-

roads would have them by themselves and use them in places for which they would be well adapted. I think that there would be but a very small percentage of such rails produced, but the very fact that the danger of rejection from over high carbon would be eliminated would cause the steel makers to feel less restricted in their procedure. In other words, it would allow a certain elasticity which would, undoubtedly, work to the advantage of both producers and consumers; of course, for acceptance, the high-carbon steel must have successfully passed the prescribed physical tests.

Another development of great interest is the triplex processes, both on the Bessemer open-hearth electric and the Bessemer and double open-hearth plans. These are being worked out in practice and, I believe, will soon be adding much toward the production of more regular and, hence, better steel, and, of course, also better rails.

A Convertible Stock Car

A DEVICE designed to convert the ordinary live stock car into a box car for general merchandise purposes has been placed on the market by the U. S. Convertible Car Company of Fort Worth, Texas. This equipment consists of moveable floors of 2-in. pine and steel folding side walls, which are hinged to the moveable floor and to the inside of the car near the roof. As shown in the illustrations, the moveable sides and floor are operated by means of ratchet cranks attached to a worm and sector device located under the car and connected to the moveable floor at each corner by a $\frac{3}{8}$ -in. steel cable moving over sheaves located inside of the car.

An old stock car to which this device has been applied is shown in Fig. 1. The water-tight live stock door *1*, with

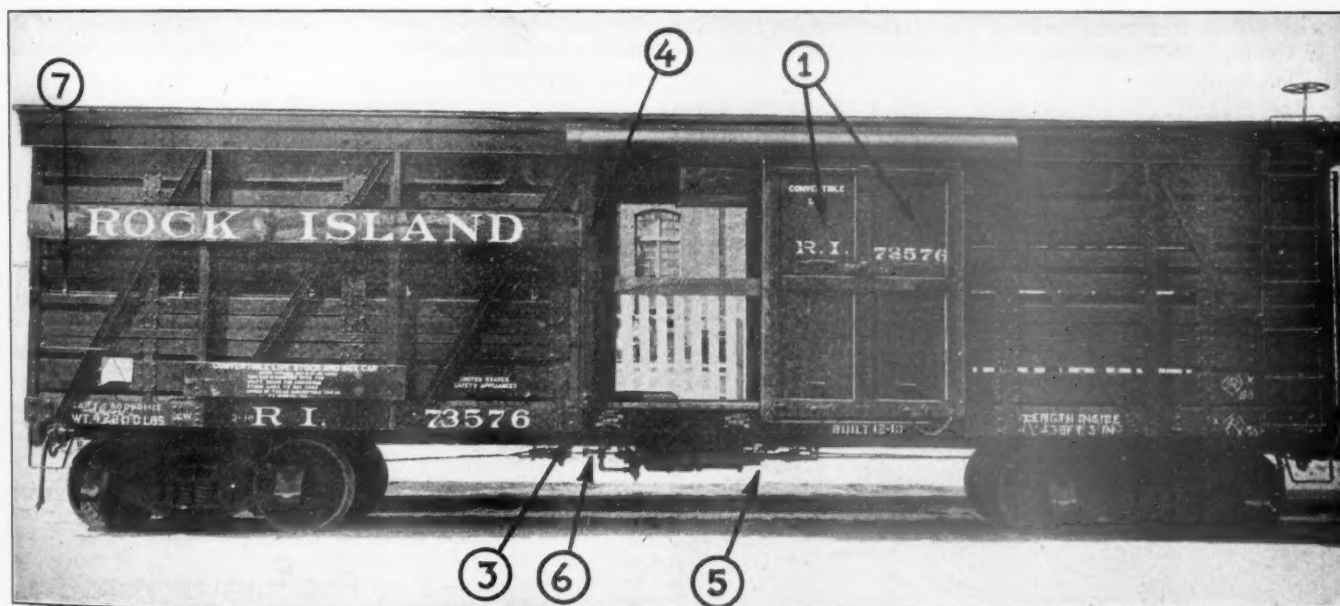


Fig. 1—A Rock Island Stock Car Equipped with the Convertible Device.

ganese and phosphorus specification prevailed, the work of the open-hearth steel melter would be simplified, the cold-ingot trouble eliminated, and, I think, better general results obtained.

As a means of lessening the tendency on the part of the manufacturers to protect themselves by keeping the carbon content of the metal toward the lower range, it would be well to accept not over an agreed upon small per cent of heats slightly higher in carbon than the specifications. These rails could be specially marked and shipped, so that the

the protector or water seal *4*, is part of the necessary equipment, although not an integral part of the convertible device. The worm and sector *3*, the ratchet cranks *5* and *6*, and the side lock bolts are located as shown. This car operated successfully for a period of more than a year.

In Fig. 2 the car is shown with one end having the convertible device raised to the top of the car, as when live stock is carried, and the other end with the device in place, as when the car is used for general merchandise or grain.

The manner in which the device operates is clearly indi-

cated in Fig. 3, which shows the folding side walls 6 and 7 as they automatically unfold, as the moveable floor 8 is lowered into position on top of the permanent live stock floor 10. In the foreground of Fig. 3 the merchandise, or moveable, floor 8 is lowered down on top of the live stock floor 10 by operating the ratchet crank. The cable 4 running over the sheave, 5 lowers the floor and the side walls unfold, the slot hinge 1 and 2, secured by the U-bolt 3, permitting the movement without any binding. The side

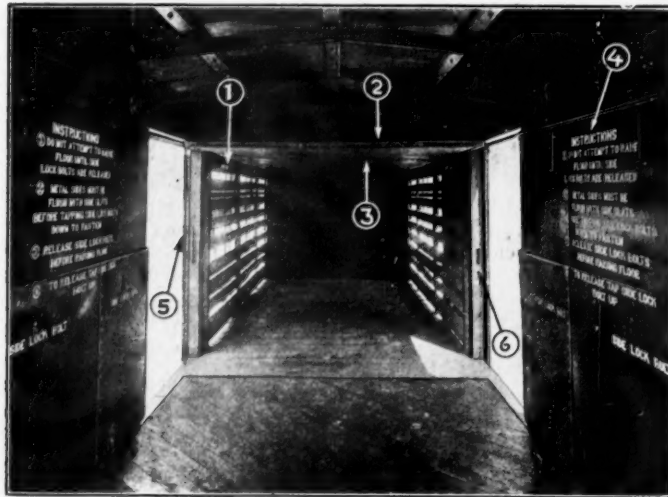


Fig. 2—One End of Car Arranged for Merchandise. (1) Safety lock; (2) Moveable floor; (3) Showing absence of any nails or projections to injure live stock; (4) Instructions for operating device; (5) Door water seal; (6) Provision for fastening grain doors.

walls are then secured against the slatted sides 11 of the car by the side lock bolts, which are secured in place by the lock bolt button 13.

The general appearance of the interior of the car when arranged for merchandise is illustrated in Fig. 4. This shows

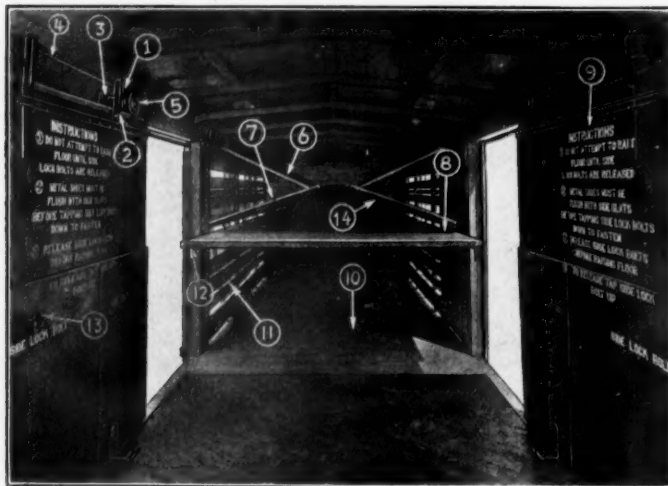


Fig. 3—One end of Car Ready for Merchandise and Convertible Device Lowering into Position in the

the clean merchandise floor 2 in place on top of the live stock floor and the ventilated door 3 closed for merchandise loading. An end door 1 is provided, so that live stock can be given necessary attention. The ends of the steel folding side walls are crimped, so that the door jamb 4 is exposed to permit the application of a grain door. With the addition of a grain door this arrangement can also be used for the transportation of grain.

A number of advantages is said to be gained by the use of this device. The transportation of live stock necessitates a type of car for which it has been impossible to find freight, of a kind that can be handled in them, in sufficient quantities to load in the cars on their return trip to the stock-

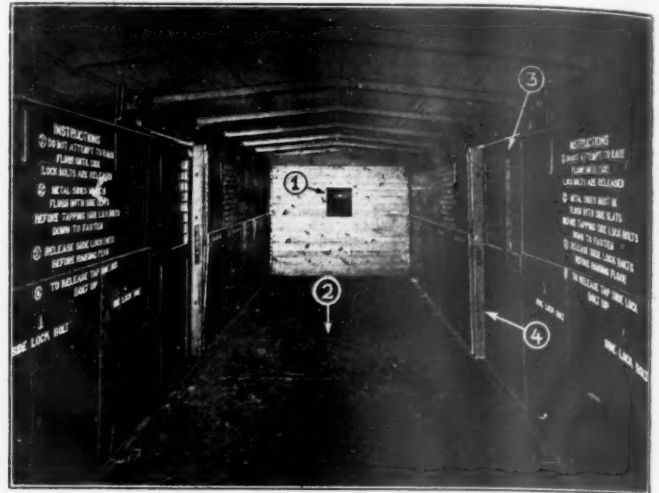


Fig. 4—Interior of Car as Arranged for General Merchandise.

raising sections of the country. This results in great loss, due to non-revenue or empty car-miles. As there are long periods when there is no live stock business, these cars must frequently lie idle, and it is estimated that the average time in service of such cars is only from 25 to 40 per cent.

This convertible appliance makes it possible to keep stock cars in practically continuous service, and the operation of the device is so simple that it is claimed that a station agent or any other person can convert from one type of car to the other without any assistance from the mechanical department.

Passenger Traffic in December

THE NUMBER OF PASSENGERS carried one mile by the railroads under federal control during the month of September amounted to 4,331,339,003, an increase of 9.2 per cent over September, 1918, according to the monthly report of the Operating Statistics Section. All regions and districts showed increases except the Southern region, which showed a decrease of 17.3 per cent. For the nine months ended September 30 the number of passengers carried one mile was 34,949,294,185, an increase of 6.7 per cent. Decreases were shown by the Ohio-Indiana district and the Southern region.

Tie Production

THE PRODUCTION OF TIES for the 10 months ended October 30 this year has been approximately 84,500,000, according to reports received by the Forest Products Section. It is estimated that the production for November and December will amount to 10,250,000, which will make the total for the year approximately 95,000,000. The number of ties inserted for renewals up to October 30 this year was 76,580,185. The production in 1918 was only 65,000,000 while 86,000,000 were inserted during the year. The number of ties on hand when the railroads were taken over in December, 1917, was about 44,000,000. This had been reduced to 36,000,000 on January 1, 1919, but on November 1 the number of ties on hand had increased to 51,000,000.

Railway Fire Protection Association Convention

Methods of Storing and Handling Inflammable Liquids and Means of Reducing Fire Hazards

THE SIXTH ANNUAL MEETING of the Railway Fire Protection Association held at the Hotel La Salle, Chicago, on November 18, 19 and 20, inclusive, was featured by extended reports and discussions on the best methods for handling and storing fuel oil and inflammable liquids and by lengthy discussion of the means of reducing the fire hazard in rolling stock. Both of the business sessions on the first day of the convention, November 18, were featured by the presentation of reports and papers dealing with the handling of inflammable and explosive liquids and fuel oil and throughout both sessions there was much discussion as to the recommendations made. The two business sessions on the second day of the convention were devoted mainly to the presentation of reports concerning heating appliances in freight and passenger equipment and the discussion thereon. The last session of the convention on November 20, was devoted largely to the question of protecting wooden bridges and trestles against fire.

The convention was formally opened at 10 o'clock on November 18, by President Robert Scott, superintendent of insurance and safety of the Atlantic Coast Line at Wilmington, N. C., who stated in his opening address that the problem before the members of the Association was to make the employees on the railroads understand their responsibility for the results arising from fire waste.

Reports of Resolution and Membership Committees

The reports of the executive committee and the committee on resolutions immediately followed Mr. Scott's address. E. B. Berry, superintendent of fire prevention of the Southern at Washington, D. C., and vice-president of the Association, speaking for the former committee, stated that the total membership in the Association had increased to 184 during the past year, or a growth of 72 per cent. C. N. Rambo, manager of the Fire Loss and Protection Section of the United States Railroad Administration presented the resolutions prepared by the latter committee. These resolutions which were unanimously adopted by the convention called attention to the following facts and measures:

- (1) The reduction in the fire waste can only be accomplished through the enforcement and acceptance of individual responsibility as a matter of daily duty, through which means carelessness and defects which produce fires may be eliminated.
- (2) To continue on each individual railroad the concerted work undertaken during federal control of railroads that there may be no let-up in protecting properties, even though actual war conditions may be past, and that the comprehensive system of education as to fire dangers and the use of every means possible of lessening the likelihood of fire occurring be continued.
- (3) The encouragement of fire-restrictive building construction and a more general recognition on the part of engineers and architects that through them and the adoption of improved building construction the first and gravest responsibilities rest in the elimination of much of the fire loss.
- (4) The more extended use of fire walls dividing structures of large areas as a means of reducing the spread of flames.
- (5) A wider general use of automatic sprinklers as a means of extinguishing fires at their incipency and a comprehensive study of the use and service of standpipes and hose, fire hydrant systems, all with abundant water supply. A greater study of the economic results of the installation of adequate fire fighting devices, eliminating a too prevalent consideration only of the initial cost.
- (6) The co-ordination of all fire prevention activities on each railroad through a central administrative officer for the promul-

gation of rules and regulations for the proper protection of properties and the guidance of officers and employees in the proper care of property in their charge or where they may be employed to guard against fire hazards.

(7) The appointment of fire marshals on divisions, districts or terminals to have charge of all fire equipment, and the formation and drilling of fire brigades and to make frequent inspections as to general care and cleanliness, in their respective territories.

(8) The full co-operation of all railroads with the Bureau of Explosives in the enforcement of rules and regulations for the safe transportation, storage and use of explosives and other dangerous articles.

(9) The continued employment of experienced inspectors to report on the conditions and adequacy of fire equipment, the condition of properties affecting the fire risk and the safeguards required to protect dangerous processes and occupancies.

(10) The rigid investigation of all fires, with particular effort to trace the cause and fix the responsibility for damage or destruction of property.

(11) The education of employees in careful habits with respect to common fire dangers through bulletins, meetings, etc.

(12) A full realization that fire insurance only partially compensates for the fire waste and is in a measure but a tax imposed on carelessness and neglect and that there is always a large consequential loss that must be considered, which is not compensated for by insurance.

Report of the Committee on Statistics

The report of the committee on statistics presented by E. B. Berry, chairman of this committee, contained interesting data concerning the number and origin of fires on railroads of the United States during the past year. This report is substantially as follows:

Through the co-operation of the Fire Loss and Protection Section of the Administration, it is possible for me to present for your information and consideration a very complete and comprehensive statement of fire losses in railroad properties for the calendar year 1918. The statement is based upon report of fires from 419 roads having trackage of 239,761 miles.

Briefly, the 419 roads under the Federal Administration reported 20,628 fires with a total loss of \$12,263,220, an average loss of \$594.50 per fire and \$51.10 per mile of road. These figures, however, include 9,923 right-of-way fires with a loss of \$1,610,190. As right-of-way fires were not reported nor included in our 1917 statement, if we eliminate the fires charged to this specific classification we have 10,705 fires with a loss of \$10,653,030 in other railroad properties. With this elimination or reduction, the average loss per fire during 1918 amounted to \$995.15 with loss per mile of road of \$44.42, as against \$857.59 average loss per fire and \$34.47 average loss per mile of road during 1917.

Notwithstanding the very large percentage of increase in the number of roads sending in statistics over previous years, we find under the risk classification report that, as in past years, rolling stock and merchandise in transit have suffered 59.9 per cent of the number of fires and 48.7 per cent of the loss. It might also be of interest to note under the risk classification statement that passenger and freight stations suffered approximately 6 per cent of the total number of fires and 9 per cent of the total loss during 1918, which compares favorably with 9.3 per cent of the loss during 1917; coaling stations suffered 1.3 per cent of the total fires and 3.6 per cent of the loss during 1918, while during 1917 the

loss on this class of property was 3 per cent; mechanical property is charged with 4.3 per cent of the number of fires and 14.5 per cent of the loss during 1918, as compared with 4.8 per cent of the loss during 1917; bridges and trestles show approximately 9 per cent of the number of fires and 4 per cent of the loss during 1918 while in 1917 the loss on this class of property amounted to 2.9 per cent.

Under the origin classification statement you will find 62.74 per cent of the number of fires and 24.42 per cent of the loss was caused by locomotive sparks. The other origins following in their relative importance as to the number of fires are as follows:

	Per cent.
Unknown	13.82
Heating appliances	4.47
Ashes and cinders	2.42
Adjacent property	2.20
Hot coals from locomotives	2.13

Of the 20,628 fires reported, there were but five individual fires with loss between \$100,000 and \$250,000, four of these were between \$100,000 and \$150,000 and one fire

STATEMENT OF FIRE LOSSES BY ORIGIN CLASSIFICATION FOR YEAR 1918

Origin Classification	No. fires	Per cent	Loss	Per cent	
				1918	1917
Adjacent property	455	2.205	\$697,930	5.691	5.492
Ashes or cinders	499	2.419	63,030	.514	.620
Boilers	50	.242	14,848	.121	.525
Careless burning of roadbed, etc.	272	1.318	119,432	.974	.456
Explosion	5	.024	3,657	.030	.506
Electric wiring	116	.562	217,066	1.770	2.883
Fire works	1	.005	2,624	.021	.001
Fuel oil systems	24	.116	53,939	.440	.156
Forest fires	54	.261	486,957	3.971	.224
Friction, hot box, brake shoes	124	.601	128,371	1.047	1.516
Fuses	9	.043	1,424	.012	.155
Gasoline, oil, etc.	72	.349	26,067	.212	1.792
Heating appliances	923	4.475	424,892	3.465	6.108
Heating appliances, car heaters (freight)	56	.271	27,959	.228	.....
Incendiary	129	.625	483,930	3.946	1.721
Lighting appliances	191	.959	147,134	1.199	.860
Lightning	58	.281	35,335	.228	.916
Locomotive, sparks	12,963	62.740	2,995,200	24.425	9.615
Locomotives, hot coals	467	2.137	166,126	1.354	1.531
Locomotives dropping hot oil	13	.063	170,379	1.389	.....
Loading charcoal, lime, etc.	213	1.032	110,323	.899	.992
Matches	99	.480	78,943	.643	.271
Smoking	161	.780	102,874	.839	1.985
Spontaneous combustion	190	.920	228,807	1.866	5.864
Tire heating	12	.058	5,214	.042	.....
Torches	118	.572	72,157	.588	1.265
Tramps and trespassers	146	.708	166,540	1.358	2.156
Unknown	2,810	13.825	3,783,751	30.853	38.040
Waste, lockers, etc.	36	.175	67,725	.552	.427
Wrecks	205	.994	1,281,248	10.449	11.209
Miscellaneous	114	.552	79,097	.650	2.714
Miscellaneous thawing pipes	43	.208	19,641	.164	.....
Total	20,628	100.000	\$12,263,220	100.000	100.000

was \$242,000, so it is obvious that our heavy aggregate losses in railroad properties come from fires reporting relatively small losses.

Right-of-way fires (property not our own)....	9,923	1,610,190	162.30
Total	20,628	12,263,220	594.50
	1918	1917	
Number of roads reporting	419	49	
Mileage reported	239,761	141,849	
Number of fires	20,628	5,701	
Loss	†12,263,220	4,899,146	
Average loss per fire	594.50	857.59	
Average (excluding right-of-way fires)	995.15	.....
Average loss per mile of road	51.10	34.47	
(Excluding right-of-way loss)	44.42	.....

*Includes 9,923 right-of-way fires not included in 1917 statement.
†Includes loss of \$1,610,190 not included in 1917 statement, being right-of-way loss.

Comments by C. N. Rambo

The principal address of the morning session was given by C. N. Rambo, manager of the Fire Loss and Protection Section of the United States Railroad Administration, who after outlining the history of the Fire Loss and Protection Section and the results that it has accomplished in reducing fire hazards said in part:

"Fire prevention work is carried on because of the well-founded knowledge that fire hazards are ever present on railroad properties. It is a continual subject for study, developing experts in recognizing defects in material things and in practices and conditions. It is the study of the elimination of causes of fires. Fire protection, on the other hand, shows its value more directly in the study of the proper application of fire apparatus of all kinds and in the study of property construction.

"I think the railroads should feel that the fire prevention service is a necessary part of their operating plan, with the removal of certain uncertainties as to extensive property loss and interference with operation, which would seem to make any reasonable expenditure for fire protection quite desirable.

"Through the work of the Fire Loss and Protection Section of the Railroad Administration there has been a constant effort to reduce the fire waste of approximately \$30,000 per day on railroads, an average loss per fire reported of nearly \$1,000 and on average loss per mile of road reported of nearly \$40. I believe that at least 50 per cent of this can be prevented, possibly more, by the exercise of individual care and by the acceptance of individual responsibility. There has been an effort made to prevail upon the approximate 2,000,000 employees to realize this individual responsibility and to prevent carelessness. This large fire loss means that much charged against the railroads' revenues, that much added to the operating expenses."

Other Reports at Opening Session

The report of the committee on use of inflammable and explosive compounds and liquids in shops was also presented at the morning session by Charles P. Beistle of the Bureau of Explosives and chairman of the committee. This

STATEMENT OF FIRE LOSSES BY RISK CLASSIFICATION FOR YEAR 1918

Risk Classification	No. Fires	Per cent.	Loss	Per cent		Average loss per fire	
				1918	1917	1918	1917
Passenger and freight stations and contents, including freight	641	5.988	\$958,511	9.0	9.876	\$1,495.	\$1,113.
Warehouse for storage of miscellaneous merchandise and contents	33	.308	209,731	2.0	.584	6,355.	134.
Automobile platforms	3	.028	1,813	.....	.....	604.	.....
Dwelling and section houses	336	3.139	114,720	1.1	.544	341.	201.
Hotels, eating houses and contents	54	.504	47,523	.4	.891	880.	968.
Office buildings and contents	93	.869	66,152	.6	.....	711.	.....
Water station and pump houses	218	2.037	113,484	1.1	.972	520.	421.
Oil tanks and contents	18	.168	100,978	.9	.080	5,609.	604.
Coaling stations and coal	142	1.327	382,648	3.6	3.078	2,694.	3,540.
Mechanical department property, including shop buildings, storehouses, round houses, etc.	458	4.279	1,539,585	14.5	4.801	3,361.	863.
Grain elevators	9	.084	116,922	1.1	.003	12,991.	53.
Stock yards, pens, loading platforms, etc.	62	.579	12,706	.1	.524	204.	546.
Piers, wharves, etc.	35	.329	131,534	1.2	23.000	3,758.	86,488.
Signal and interlocking towers	113	1.056	94,851	.9	.984	839.	134.
Bridges and trestles	946	8.836	461,208	4.3	2.972	487.	283.
Rolling equipment	5,453	50.940	2,450,615	23.0	19.739	449.	437.
Merchandise in transit in cars	963	8.995	2,739,263	25.7	15.265	2,844.	1,469.
Floating equipment	17	.159	37,930	.4	1.461	2,231.	4,202.
Contents of floating equipment	1	.009	270	.0	.....	270.	.....
Cotton platforms and warehouses	13	.121	10,318	.1	.608	793.	2,265.
Cotton-carrier and warehouse man's liability	138	1.289	518,036	4.9	6.016	3,753.	2,001.
Miscellaneous, all other property not specified	959	8.958	544,233	5.1	5.432	577.	301.
Total	10,705	100.000	\$10,653,030	100.00	100.00	\$995.	\$857.59

report went into detail concerning the uses of gasoline, benzine, paint and varnish, oils, wood alcohol, paint and varnish removers, lacquers and compressed gases in railway shops and contained many recommendations for reducing the fire hazard in handling these commodities. The paper evoked considerable discussion regarding its recommendation for the handling of gasoline and the containers therefore. As a result of this discussion the report was accepted as a progress report and suggestions were made to the committee for further consideration.

The morning session was closed with a paper presented by F. H. Elmore, on the "History of Our Association and What It Has Accomplished."

Use and Handling of Fuel Oil

The afternoon session on the first day of the convention was featured by the presentation of the report of the committee on oil burning appliances by B. S. Mace, chairman of the committee, and a paper presented by A. M. Schoen on "Fuel Oil vs. Coal for Locomotives." The report of the committee on oil burning appliances indicated that the committee had taken a great deal of care in its preparation and the report was prepared and distributed in booklet form. A liberal use was made of drawings to illustrate its recommendations. The length and detail of this report prohibit its reproduction here; however, the committee has printed 1,000 copies of the report which are to be sold through the secretary of the association. The report is the result of three years' work on the part of this committee and it contains specific rules and requirements for the storage and use of fuel oil and for the construction and installation of oil burning equipment.

Mr. Schoen's paper on "Fuel Oil vs. Coal for Locomotives" contained many recommendations concerning the various kinds of fuel oil, the methods of handling oil and the fire hazards involved, and said in part:

While oil has been used for locomotives in the West and on the Florida East Coast for a number of years, there would appear to be no well-defined standards to govern; even the individual roads seem not yet to recognize this fuel as permanent to such an extent as to formulate standards for their own use. The time now appears to have arrived, however, for changing all this and formulating standard specifications in an advisory form at least, that may be adopted by these roads preparing to adopt oil as fuel and to be worked toward, either in changes or new work by those roads having equipment already installed. From all reports the Mexican oil fields appear almost inexhaustible and bearing in mind the case of handling, reduced cost of firing and the independence of mine strikes incident to this fuel as compared with coal, there is reason to anticipate its very widespread adoption especially by roads not remote from large navigable waterways, while the recently developed colloidal fuel in which pulverized coal to a percentage of something like 35 per cent can be held in suspension in the oil will doubtless go far toward justifying the adoption of oil by many of the far inland systems.

Much more attention has been paid to locomotive efficiency than to safeguarding the storage at points along the right of way, the loading and unloading of the oil and the fueling of tenders. Among special weak points noted may be included: unloading tank cars to storage tanks, location and protection of large storage tanks, inadequate valve equipment in pipe lines, gravity feed to locomotive tenders, electric driven pumps having remote control not arranged to best advantage, oil columns dirty, wasteful and unsafely arranged, gravity and flash point of oil not kept within safe limits.

The wide variation in the flash test and viscosity test of the oils used for fuel purposes in different parts of the

United States forms one of the obstacles to the determination of uniform standards, the gravity test varying from 12 or 13 deg. Baumé to as high as 30 and 32 deg. Baumé, while the flash test of untopped or undistilled oil varies from atmospheric temperatures up according to their constituents; at this date, however, it would be quite safe to say that almost without exception only topped oils are being used in railroad work.

There are two distinct kinds of oil obtained from the earth's underground reservoirs, one having a paraffine base such as that found in Pennsylvania, West Virginia, and now being found in Texas, which contains all the valuable petroleum products and is subjected to the process of fractional distillation, being too valuable to use for fuel purposes; the other has an asphaltum base, most of it being found in Mexico, California and Louisiana, with some in Texas; this oil has only a small proportion of the more valuable petroleum products in consequence of which it is subjected to fractional distillation to only a moderate extent, most of it being merely "topped" by which the lighter or more dangerous ingredients are taken off and the residue is sold for fuel purposes. Under flash test the oil used for fuel should not test lower than 150 deg. F. closed cup, or 160 deg. F. open cup test. So far as the fire hazard is concerned, of course, the gravity test is of small importance except that the lighter the oil the more readily it flows. Oil testing from 18 deg. to 26 deg. Baumé is ordinarily a good viscosity for practical purposes and the heavier oils are oftener blended to bring them within these limits. When the viscosity is very low, especially in cold weather, it is found necessary to equip both storage tanks and tenders with circulating steam coils so that the oil may be warmed sufficiently to enable it to flow more freely. Where this warming process is used the oil should never be heated to a point higher than 40 deg. F. below its flashing point.

The generally accepted standard today for large storage tanks of this character so far as capacity is concerned is 55,000 bbl. at 42 gal. The standard tank as constructed is steel throughout, that is, top as well as bottom and sides. In the past many of these tanks have been built all steel, except the top, which was built of matched boards and covered with galvanized iron. Investigation shows, however, that this form of tank has been the one to especially suffer from fire, and it is now uniformly agreed that the highest degree of safety lies in the all-steel tank with proper protective equipment provided. The covers of the tank should be equipped with manhole, explosion hatches and relief vent; the relief vent should be protected by not less than two thicknesses of not larger than 30-mesh nickel gauze separated one-half inch or more to prevent any fire striking back through escaping gases. The explosion hatches should operate quickly and positively and form a gas tight closure, as should the hatch to the manhole. Tanks should be set solidly on adequate foundations and should be enclosed by a levy or dyke having capacity of at least one and one-half times the capacity of the tank and built with a crest of not less than three feet and a slope on either side of not less than two to one. Any pipes should either be carried over the embankment or through wing walls of concrete. An O. S. & Y. valve should be set in the supply pipe inside the levy and near the tank.

The large tanks should be at a distance of not less than 350 feet from buildings or other combustible property, and this may well be made the minimum distance from the main line of the road as well, owing to the fact that should the tank be on fire and a strong wind blowing in the direction of the tracks the burning gases and dense smoke could be driven a considerable distance, and if the tank is not sufficiently isolated the operation of the main line trains might be affected for a considerable time. Also the tanks should be so located and protected that under no circumstances

could the oil reach streams, either flowing or tidal, by means of which it might be carried into the proximity of destructible property.

It is strongly recommended that the fueling of tenders by gravity pressure be avoided, in view of the danger of the entire contents of the tank escaping in event of accident. Most approved practices would require the oil to be pumped into the tender from reservoirs constructed below the grade level, which would permit of the flow being promptly shut off in event of accident to the piping or apparatus. These wells can be filled at regular intervals either by gravity feed from the large storage tanks or else direct from the tank cars. These underground reservoirs, if completely covered over, may be located at such points as may be most convenient for their intended purpose. Usually they should be constructed either of reinforced concrete or steel.

Tank cars are arranged for unloading through a pipe in the bottom, fitted with a cap at the outer end and a valve where it leaves the tank. This valve is opened and closed manually from the top of the car. With the cap screwed tightly in place, the tank car may be filled with the valve wide open, and no one will be the wiser until the cap is removed, when a large part of the contents will be lost before a man can climb to the top of the car and close the valve. It seems that this sometimes occurs and two or three thousand gallons of oil escape into the yards before the trouble can be remedied. For this and other reasons it is recommended that at unloading points pits be constructed between the tracks, 4 to 6 inches in length, over which the tank cars may be placed and their contents allowed to discharge into these pits. Through proper size pipes the oil can be flowed from this point to underground pumps of suitable capacity, from which it may be pumped to the storage tanks. This arrangement will reduce the time of unloading, improve surrounding conditions as to care and cleanliness and minimize the fire hazard.

Oil columns are vertical pipes, with a horizontal arm used for conveying the oil to the opening in the tender. In some forms the arms are arranged to swing vertically, in others horizontally, and others the vertical pipe or column itself can be turned on its axis in a horizontal plane. Oil-tight stuffing boxes are provided at the joints to prevent escape of the oil. Of the various oil columns I have seen, each has its objectionable features. The drop pan arrangement on the Rose column commends it for cleanliness, but the rigid self-cleaning telescoping device that transcends into the tender opening sometimes results, I am told, in the whole column being torn down when the locomotive moves off prematurely. The determination of the type of oil column desired would be a matter for the consideration of the motive power department, but whatever type is determined upon should be equipped with rapid closing gate valves at the base of the standpipe, and unless a man is to be kept at this valve while filling there should be another on the horizontal arm that can be reached by the man standing at the tender opening, and if an electrical signal to pump house or remote pump control is used the button should be promptly available to the man at the filling point. All stuffing boxes should be well made mechanically and kept in non-leaking condition.

Oil should be pumped from reservoirs to tenders by steam or electric pumps, which pumps should, wherever practicable, be arranged in duplicate in order that pumps in bad condition may be shut down at suitable times for repairs without interrupting the service. At shop yards and other places where steam is at all times available, the pumps should have permanent steam connections, and if so located that an accident to any of the oil equipment might make them unapproachable they should be equipped with remote control, by means of which they could be stopped quickly in case

of emergency. At points where oil stations are considered necessary but no steam is available the pumps could be arranged for connection to the locomotive blower pipe and steam for filling furnished from that source. Air pressure from the locomotive air system might be used for filling purposes under extreme conditions, but this is considered ordinarily undesirable for mechanical reasons.

The greatest hazard to which tanks under ordinary circumstances have been subjected has been from lightning, though there has been a general misapprehension as to just how the tanks have been affected, it being thought that the steel tanks are struck by the lightning discharge and their contents ignited. As a matter of fact, tightly closed oil tanks need not be considered in any special danger from lightning, as they are not very high, expose a large mass of metal and, ordinarily resting on the ground, may be expected to provide a very fair path to earth even if struck. The tanks that are in most danger are those from which the lighter hydro-carbon gases are being thrown off, as a lightning flash in the vicinity may ignite these and flash back to the oil in the tank, which will then burst into flame and continue to burn. This is especially liable to happen when sulphuretted hydrogen gas has been brought over in suspension and is being liberated.

Naturally these accidents generally happen to the tanks containing crude oil, or else the very light products of petroleum. Fuel oil that has been properly treated should be very nearly immune, especially if it stand in properly constructed tightly closed *all-steel* tanks. The necessary vent can be effectually protected by means of small mesh metal gage, using the same principle as that embodied in the Humphrey Davy miner's lamp. When the ground on which the tank rests is very dry, or when raised on supports, artificial grounds should be provided.

The two principal agents that have been employed for the extinguishment purposes are steam and Firefoam foamite, both of which embody the same principle, namely, shutting off the air from the surface of the burning liquid and thus depriving it of the supply of oxygen that supports combustion. So long as the tank remains tight steam will render effective service, otherwise the blanketing effect is largely lost. This protection is accomplished by means of steam jets inside the tank above the surface of the oil supplied from boilers and through pipes of adequate capacity.

Foamite is a foam very much like soapsuds and is produced by bringing together two chemicals in liquid form which react when mixed to form a thick foam like soapsuds, which floats on the surface of the oil and blankets the fire. The equipment necessary to the protection of large tanks is rather extensive as well as expensive, and ordinarily is not justified except in yards or terminals, when a single equipment can be extended to protect all tanks. Foamite is especially valuable when the oil surface is exposed. All-steel tanks properly constructed, well grounded, with all seams tight, equipped with explosion hatches and proper vent and surrounded by well-constructed devices, present little if any fire hazard, unless it be from exposure of other property. In case of an installation of this kind, however, the greatest danger point will be the vent which should be regularly inspected to see that the gage service continue intact.

In addition, a paper was presented to this session of the convention by W. A. Fravel on "The Disposition of Sweepings and Rubbish from Warehouses, Freight Cars, etc."

Protection of Rolling Stock

The morning session on the second day of the convention was featured by the report of the committee on freight car heaters, presented by E. A. Ryder, chairman of the committee. The report brought forth considerable discussion as

to its recommendations; it was finally adopted by the association as a progress report.

W. S. Topping, assistant chief inspector, Bureau of Explosives, also presented a paper on "Methods of Handling Wrecks or Derailments Involving Tank Cars of Oil, etc." Mr. Topping recommended that in case of a wreck involving tank cars containing inflammable liquids the following rules should prevail:

- (1) Post guards and keep all spectators away.
- (2) Locate all leaks and stop them if possible, using only electric flashlights or electric hand lanterns when lights are necessary. If open flame lights must be used keep them elevated as much as possible.
- (3) Dig holes and trenches to bury exposed and leaking gasoline that cannot be transferred promptly to tight containers.
- (4) Allow reasonable time after stoppage of leaks and burial of gasoline for vapors to escape from wreck and vicinity.
- (5) Keep steam crane fire to windward as much as possible and not less than 500 feet away until completion of work to this point.
- (6) First move to safety the least injured cars to avoid starting new leaks during handling by crane. When leaks are to be expected in handling, empty the car first either by transfer of contents to other car or container, or by drainage to a hole or trench in the ground for burial.
- (7) Do not allow trains to pass on adjoining tracks, especially on same or lower level, as long as gasoline is leaking or exposed in quantity. When allowed to pass keep fire doors and ash pan slides closed and draught shut off.
- (8) The placing of leaking tank cars for repairs in close proximity to shops where fires or naked lights are maintained must be avoided.

Handbook on Railroad Fire

Prevention and Protection

E. B. Berry, chairman of the committee preparing for Handbook on Railroad Fire Prevention and protection, presented a tentative outline of the book. In general, it is the idea of the committee that the book will be divided into two major sections, one being a general section, the other a special section. The general section will include the various railroad properties by risk classifications, to be treated in detail, showing the risk, common and special hazards, practical remedies and fire protection recommended. It is proposed that the general section be divided into sub-sections, each dealing with a specific class of risks. In other words, there will be a sub-section for mechanical property, transportation property, a section for merchandise and traffic at stations and rolling stock, etc. The special section will treat on all other independent subjects applicable to fire prevention and protection of railroad properties.

W. H. Merrill, president of the Underwriters' Laboratories, Chicago, also addressed the morning session.

Protection of Passenger Train Equipment

The afternoon session of the second day's convention was featured by the report of the committee of fire protection in passenger train equipment, which was presented by E. W. Osborne, chairman of the committee. The general conclusions in this report are as follows:

- (1) We believe that, except in local trains specified, every coach, whether metal or wood, in main line trains should be equipped with at least one fire extinguisher, and that in local or branch trains of four cars or less there should be two in each car.
- (2) That in general the liquids used in fire extinguishers should be non-freezing, but exceptions may be made where means are available for protecting liquids that are not in themselves resistive against cold.
- (3) That an extinguisher with a capacity of at least $2\frac{1}{2}$ gals. containing a chemical charge which has the cooling effect of water, such as is found in the calcium chloride or acid-soda types is especially to be desired in baggage and other non-passenger carrying cars.

(4) That some method should be adopted to make upholstering fire resistive.

(5) That all cars should, as far as practicable, be lighted with electricity installed according to requirements of the National Electric Code.

(6) That smoking cars should be positively prohibited in non-passenger carrying cars.

(7) That all fire extinguishers should be given the necessary tests or examinations at terminals prior to each trip to insure their being in good condition.

(8) That sufficient supplies should be kept in coach yards for immediate charging of extinguishers.

This report, like many others presented at the convention, brought forth considerable comment, and it was finally adopted as a progress report. After the presentation of a paper by E. B. Berry on the "Future Work of Our Association," the convention adjourned to visit the Underwriters' Laboratories in Chicago.

Protection of Wooden Bridges and Trestles

The closing session of the convention on Thursday morning was featured by a paper by O. B. Heppner, chief chemist of the St. Louis-San Francisco, who spoke on "The Relation of the Chemist to Fire Protection," and the report of the committee on the protection of wooden bridges and trestles against fire, which was presented by A. W. Smallen, chairman of this committee, and the election of officers. Mr. Heppner's paper told of the assistance which could be rendered to fire protection by the chemist and the chemist's relation to the success or failure of fire prevention measures. The report of the committee on the protection of wooden bridges and trestles against fire contained specific recommendations for preventative measures and for fighting fires which have been able to gain some headway. These recommendations are as follows:

As preventative measures it is recommended:

- (1) That effective spark screens be provided in the front end of all locomotives and carefully maintained.
- (2) That ash pans and grates be made tight and kept in good working order, as the dropping of hot coals or ashes is a source of a large amount of our trouble.
- (3) That special places be provided for the dumping of cinders and ashes, and grates are not to be shaken down except at safe points.
- (4) That all combustible refuse such as dry leaves, dead grass, weeds, brush and rubbish be cleared away from under and around all wooden bridges.
- (5) That the decks of all wooden bridges, between the rails, be covered with No. 22 galvanized iron, this to prevent sparks from setting fire to the structure should they be dropped from the locomotive.
- (6) As a further preventative measure, it is recommended that all wooden bridges be coated with a fireproof or fire retardant paint, demonstration having proven some of them to be of excellent protection, and can be applied at a cost no greater than that of ordinary paint.

As protective measures it is recommended:

- (1) That one water barrel and one pail be provided for all wooden bridges of a length of 50 ft. or less, and two water barrels and two pails one to each barrel, be provided for all bridges whose length is more than 50 ft. up to a length of 150 ft., and that one water barrel and one pail be provided for each additional 150 ft.
- (2) That where a bridge requires one or two barrels and pails the same are to be placed at the ends of the bridge, located at proper clearance from the track and buried in the ground to within six inches of the top, and where barrels and pails are located in the middle of the bridge, they are to be located at proper clearance from the rails and the top of the barrel is to be provided with a wooden or galvanized cover.
- (3) In the past a great difficulty has been experienced in keeping pails intact with the water barrels, especially where galvanized iron pails or fire buckets have been used, and they are invariably missing when wanted and it is therefore recommended that a square wooden bucket of unfinished lumber be

provided and that the same be suspended in the water inside of the barrel.

(4) As a further means of extinguishing the blaze, it is recommended that all locomotives be equipped with fire-fighting apparatus so that they may cope with the situation should occasion arise.

The report, after considerable discussion, was accepted as a progress report, with the understanding that the next report of this committee will be made to include all bridges of all types. Considerable discussion arose over the fifth preventative measure and also over the second recommendation for extinguishing the blaze.

Other Business

The following companies arranged exhibits in connection with the convention: Aero Alarm Company, New York; Ohio Injector Company, Chicago; Nu-Ex Fire Appliance Company, Ohio; Pyro-Non Paint Company, and the Fire Protection Equipment Company, Chicago.

The election of officers, held at the last session of the convention, resulted as follows: President, E. B. Berry, superintendent of fire prevention, Southern Railway, Washington, D. C.; vice-president, W. F. Hickey, superintendent of fire prevention, New York, New Haven & Hartford; secretary and treasurer, R. R. Hackett.

Train Accidents in October¹

THE FOLLOWING is a list of the most notable train accidents that occurred on the railways of the United States in the month of October, 1919:

Collisions						
Date	Road	Place	Kind of Accident	Kind of Train	Kill'd	Inj'd
20.	Southern	McGriff, Ga.	xc	P. & P.	0	80
30.	Ft. Worth & D.	Rhome	rc	P. & P.	0	6
*30.	G. C. & St. Fe.	Crowley	rc	F. & F.	0	1
Derailments						
Date	Road	Place	Cause of Derailment	Kind of Train	Kill'd	Inj'd
2.	Pennsylvania	Doyleford	acc. obst.	P.	0	1
4.	Pennsylvania	S. Elizabeth	b. rail	P.	0	25
4.	Pitts. & L. Erie	W. Ellwood J.	b. wheel	P.	0	17
10.	Erie	Belmont	ms.	F.	2	0
†12.	Missouri Pac.	Wagoner	b. rail	P.	1	15
14.	Central N. J.	Marlboro	acc. obst.	P.	1	1
17.	St. Johnsbury & L. C.	Cambridge J.	d. eq.	P.	0	2
22.	Cent. Georgia	Eatonton	b. rail	P.	0	2
28.	Wabash	Percy, Ia.	b. rail	P.	0	1
29.	Gulf Coast L.	Mariana	d. wheel	P.	2	1
†29.	Sou. Pacific	Vincent, Cal.	exc. speed	P.	10	139
30.	Erie	Jersey City	exc. speed	P.	0	0
30.	Tenn. Central	Obeys City	unx	F.	2	0

The trains in collision at McGriff, Ga., on the 20th, at 1:50 a. m. were southbound passenger No. 7 and northbound passenger No. 8. The northbound train was entering a side-track, and was struck in the middle by the southbound, wrecking and overturning one coach. About 80 passengers were injured, none seriously. The southbound train had an order to hold the main track and meet No. 8 at McGriff, which is the schedule meeting point for these trains. No. 8 had arrived three or four minutes before No. 7 and a trainman had thrown the switch for the side track and signaled the engineman to proceed into the side track. The electric headlight of No. 8 was not burning, because of an armature having been burnt out; and the engineman of No. 7 thought that the other train was clear of the main line; and seeing the hand signal given by the trainman to No. 8 he construed it as for himself. This engineman had been in the service 33 years, and was classed as one of the best on the division.

¹Abbreviations and marks used in Accident List:
rc, Rear collision—bs, Butting collision—xc, Other collisions—b, Broken—d, Defective—unf, Unforeseen obstruction—unx, Unexplained—derail, Open derailing switch—ms, Misplaced switch—acc. obst., Accidental obstruction—malice, Malicious obstruction of track, etc.—boiler, Explosion of locomotive on road—fire, Cars burned while running—P. or Pass., Passenger train—F. or Ft., Freight train (including empty engines, work trains, etc.)—Asterisks, Wreck wholly or partly destroyed by fire—Dagger, One or more passengers killed.

The trains in collision on the Fort Worth & Denver, at Rhome, Tex., on the 30th, were southbound passenger trains. The leading train was standing at the station. The impact crushed its rear car. Six passengers were injured. There was a dense fog at the time.

The trains in collision on the Gulf, Colorado & Santa Fe, at Crowley, Tex., on the 30th, were southbound freight. The leading train, standing at a water tank, in a dense fog, was run into at the rear by the following train, and twelve cars were ditched. Nine tank cars, containing oil were burnt up, together with parts of the locomotive and of other cars. One brakeman was injured.

The passenger train derailed on the Pennsylvania Railroad near Daylesford, Pa., on the 2nd, was the Metropolitan express, eastbound, No. 40, traveling on track No. 2. A freight train moving westward on track No. 3, two engines and 105 cars, was preparing to make a stop when the ninety-third car, an empty wooden box car of 30-ton capacity, buckled and, with three other cars, was thrown off the track, blocking track No. 2. Train No. 40 ran into the wreck, a dense fog and the speed of the train thwarting the efforts of the flagman of the freight to stop it.

The locomotive was overturned. The fireman was slightly injured. One baggage car and four sleeping cars ran off the track, but no other personal injuries were reported.

The train derailed at South Elizabeth, N. J., on the fourth, was eastbound local passenger No. 3800 carrying about 350 passengers, moving at about 35 miles an hour. Four coaches were derailed and 25 passengers sustained minor injuries. The accident was due to a broken rail which failed because of a transverse fissure.

The train derailed at West Ellwood Junction, Pa., on the night of the 5th, was a westbound express passenger No. 19. The train running at about 50 miles an hour was derailed by a broken wheel. Four employees and 13 passengers were slightly injured.

The train derailed on the Erie Railroad at Belmont, N. Y., on the morning of the 10th, was a first-class train, westbound, No. 9, consisting of a locomotive, 16 express cars, and a car at the rear in which the train crew were riding. While running at about 60 miles an hour, the engine was thrown off the track by passing over a misplaced switch and into a side track; and the engineman and fireman were killed. Track repairers working near the spot had left the switch open. The line approaching this switch is straight for about two miles. The track foreman and his men were close to the switch; they had removed their car from the track but had neglected to straighten the switch. This accident occurred in broad daylight. The switch target is plainly visible for a good distance. The trackmen were within about 60 ft. of it and the foreman stood close to the switch-stand. The line is operated under the manual block system, but this switch is not near a block station and it has no distant signal.

The train derailed near Wagoner, Okla., on the 12th, was a northbound passenger. Two coaches were overturned. One passenger was killed and 15 were injured. The derailment was due to a broken rail.

The train derailed at Marlboro, N. J., on the 14th, was a passenger No. 220. The locomotive was derailed by striking an automobile on a crossing and was overturned. The engineman was fatally scalded, and a brakeman was injured.

The train derailed on the St. Johnsbury & Lake Champlain, near Cambridge Junction, Vt., on the 17th, was an eastbound mixed train. While running at about 40 miles an hour, a milk car near the front of the train was derailed and ditched. One passenger and one express messenger were slightly injured. The derailment was due to a loose chafing iron which became detached and fell out of position.

The train derailed near Eatonton, Ga., on the 22nd,

about 10 p. m., was northbound passenger No. 19. The locomotive was thrown of the track at a switch and was overturned, the engineman and fireman were injured.

The train derailed near Percy, Iowa, about 20 miles east of Des Moines, on the evening of the 28th, was eastbound passenger No. 14. Four coaches were overturned but the reports say only one passenger was injured. The derailment was caused by a broken rail.

The train derailed at Mariana, Tex., on the 29th, was southbound passenger train No. 3. Moving at about 20 miles an hour the locomotive and tender were derailed at a frog, by reason of a broken tender-wheel flange, and were overturned; and the engineman and fireman were fatally injured. The locomotive fell against a freight car standing on a side track and a man in charge of one of these cars was injured.

The train derailed on the Southern Pacific near Vincent, Cal., on the 29th, was eastbound passenger No. 50. The locomotive, the tender, two baggage cars and five coaches fell down a bank. One passenger, two trainmen and two trespassers were killed and 143 passengers were injured, five of them fatally. The train ran off the track at a curve of 8 deg. 10 min., on a descending grade of 2.2 per cent; the cause was excessive speed. Estimated damage to engine, cars and roadway, \$40,000. All evidence concerning the track indicates that it was in perfect condition.

This is the first serious train accident in which a passenger has been killed, on the Pacific System of the Southern Pacific—7,050 miles—since July 4, 1908, or over 11 years.

The train derailed near Jersey City, N. J., on the 30th, was eastbound passenger No. 1112. Seven cars, well filled with passengers, ran off the rails, but no personal injuries are reported except those classed as "slight." The cause of the derailment is given as excessive speed in passing from the Northern of New Jersey branch to the main line.

The train derailed near Obe City, Tenn., on the 30th, was a westbound freight. The two locomotives drawing the train crossed a trestle (No. 7.83) in safety, but 13 of the 20 cars in the train fell through to the ravine below. Two brakemen were killed. The cause of the derailment was not determined.

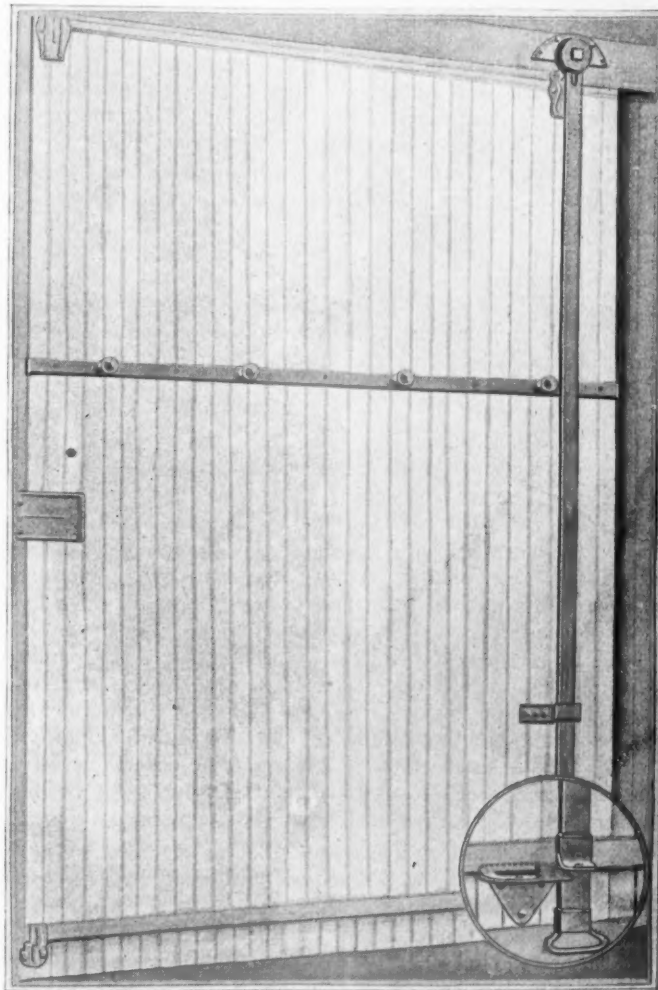
Canada.—Westbound express train No. 19 of the Grand Trunk, moving at full speed, ran off the track at Rideau, Ont., on the morning of October 23, about 1 o'clock, 11 cars going off the rails; but a broken rib of the express messenger is the only serious injury reported.

Electric Car Accidents.—In a rear collision of electric cars near Fredonia, N. Y. on the 4th, five persons were killed and 13 injured; and in a rear collision on the Interborough Elevated line in the Bronx, New York City, on the 21st, three persons were killed and 14 injured. In the New York collision two passenger cars were badly crushed, but there were only a very few passengers in them.

Freight congestion was troublesome in England even before the great strike. The London Times of September 9 reported manufacturers in Leeds as bitterly complaining of the holding up of merchandise owing to inadequate railway facilities. "Many hundreds of tons of goods have been held up for some time, and business men are at their wits' end to deliver goods to their customers. The railways are still refusing to take goods, except small consignments at occasional intervals. One woolen mill head reports that the Great Northern allowed him to send 10 cwt. of cloth to London last Thursday. Although he had tons waiting to go, since then he had not been able to get anything away. For more than a fortnight he had been wanting to dispatch a number of bales of cloth to Bristol via the Midland Railway, but the company refused to take it until yesterday, when only a small portion of an order was accepted."

A Radical Departure in Freight Car Door Fixtures

ONE OF THE TRYING PROBLEMS which railway employees have to face is that of opening freight car doors without damage to the doors. A new device which is intended to overcome this difficulty is the Jerry Loc-Lever. The Loc-Lever works on the leverage principle and when applied takes the place of locks, hasps and starters. The iron bar which forms the lever proper is suspended from the side plate of the car by a bolt and reaches a point a few inches below the lower edge of the car door. Another bar is fastened to the car door and extends across it horizontally about one-third the way from the top. To this are attached four fulcrum pinions formed of bolts inserted



A Combined Floor Lock and Opener

through steel tubes, large enough in diameter to revolve around the bolt and thus form a roller bearing. The handle of the main lever is so constructed that the seal or the lock of the car can be inserted through convenient orifices.

In operation, when the door is closed the Loco-Lever bar lies against the last pinion and holds the door securely in place. When the door is to be opened the seal is broken, thus releasing the lever, which is then raised away from the car a distance sufficient to pass it over the last pinion, against which it then lies in a diagonal position. A pull is exerted on the handle and from the resulting leverage the door is forced open a short distance. The operation is repeated on the three other pinions in turn, with the result that the door is fully opened without damage.

The device takes its name from the nickname of its in-

ventor, H. F. Jerolaman, of the traffic department of the Atchison, Topeka & Santa Fe, who is familiarly known as "Jerry." In his work Mr. Jerolaman noted the difficulties encountered in connection with the opening of car doors and this device is his idea for overcoming the trouble. Besides effecting a considerable saving in the damage ordinarily done the car door, it is anticipated that the device will also save time at stops and transfer points.

Standard Stock Sheets for Storekeepers

By W. L. W.

ONE OF THE MOST DIFFICULT THINGS confronting the storekeeper today is the problem of preparing a suitable record for recording the receipts, issues and consumption of material. The primary and essential thing to know is what is standard material and, therefore, each railroad should have a stock book in which should be shown by stock accounts the material which is standard for the various classes and kinds of equipment. Sufficient copies of this book should be made and supplied to all storehouses and departments, so that in ordering material, uniform sizes and kinds will be furnished.

It is a very common practice on most railroads today for every shop to order a different kind of material for the same purpose, and the result is that it is most difficult to transfer such material from one point to another. On the Pennsylvania Lines West a number of years ago a standard stock book was prepared showing in detail all of the items of material that were standard in the motive power department. On this sheet is shown the page and line number, description, entry number, blue print specification, etc., with columns for amount on hand, due, consumed, etc. These books are corrected currently by the general superintendent motive power when it is necessary to change specifications or reissue blue prints. Among the principal reasons for adopting this method were:

(a) Standardization of items; (b) to keep up to date the record of reissues of prints and specifications; (c) elimination of non-standard material; (d) to insure the use of uniform names for various items of material; (e) to provide an easy and simple method of checking surplus material; (f) to give a standard record of material ordered, received and consumed; (g) to assist the purchasing agent in placing orders by insuring uniformity in all items on requisition.

In standardizing the items it was found that after all the records were compiled, there were 156 different sizes of window glass. After checking over the standard items it was possible to eliminate 101 sizes. In the item of belting, one-third of the sizes were eliminated, even though it was necessary to change some pulleys to do so. Bar iron, lumber, brass castings, screws of all kinds, magnesia lagging, wheels and axles, small tools, and practically all other items showed substantial reductions. As an illustration, seven different sized cores of cast-iron wheels were being specified in order to take care of requirements, not only for home but also for foreign equipment. On account of the wheel-boring capacity of the shops it was felt that by ordering the cores of various sizes, an increase in output could be secured from the machines on account of reducing the number of cuts necessary to bore the wheel. It was found, however, in anticipating the requirements for wheels on the various wheel makers, that they were also in a measure anticipating our requirements, and the result was that at times we had a large supply of wheels on hand, but not the kind of bore required. The blue prints were changed, reducing the number and sizes of cores to two for each wheel, and the whole situation was much improved, as this made it practi-

cal for the shops and also the foundries to carry fewer wheels than before, without holding a surplus on account of core measurements.

For another example, take the small tools, such as wood boring bits. It developed in the check that at 26 shops there were practically every size known or made. As an illustration, the $\frac{3}{4}$ -inch size varied from 6 inches in length to 20 inches, with 14 different lengths. It would seem that one size would be all that was necessary; that is, the size that would bore any piece of wood that would pass under the housing of the machine and likewise the thinnest piece. It was amusing when the various foremen were questioned as to why they wanted certain sizes, and finally admitted that they had always ordered and used them. Three lengths were finally agreed to, reducing the number of this size alone 11 items

6,000 Items Eliminated

Every item of material was gone over and a standard was established, resulting in the elimination of some 6,000 items from the stock books. After this record was put in use a comparison was made of January 1, 1915, with January 1, 1904, and the results were as follows:

Locomotives in service increased.....	92 per cent
Passenger cars increased.....	36 per cent
Freight cars increased.....	17 per cent
Stock on hand increased.....	9 per cent
Stock consumed per locomotive mile, decreased.....	21 per cent
Stock on hand per man employed, decreased.....	30 per cent

However, the stock on hand today is in value greatly in excess of this amount, due largely to the increase in price as well as quantity on account of conditions brought about by the war.

In checking surplus material and transferring it from one shop to another, by having the standard book it is unnecessary to mention the articles, as all articles are on the same page and line. Only the page and line number are given in communications between shops. It has been of great assistance in the placing of orders by the purchasing agent to have one name, standard sizes, etc.

Another very important thing that has developed, which probably every shop has experienced, is the question of charging out material in the freight car repair yard. On account of a large percentage of car repairmen being foreigners, it was very difficult for them to learn the names of the innumerable kinds of material so that they could intelligently describe to the foreman what was wanted. It was a common sight to see from four to eight men waiting in line to secure their material orders. It was the practice to account for the material issued just as carefully as for material received. On account of the shortage of experienced help, it was decided to change the methods of handling material in the freight car repair sections. The rough material of all kinds is now carefully piled or placed in bins, the new separated from the second-hand. Instructions have been issued in the form of notices printed in as many different languages as there are employees, calling attention to the fact that they are permitted to take material from bins or piles just as needed, but they must not disturb the material nor take more than required to complete the job. Special attention is given to the material received, new or reclaimed, and at the end of the month an inventory is taken, and the quantity represented by the inventory at the close of the previous months, plus the quantity received during the month, less the quantity on hand per inventory at the close of the current month, represents the charge to freight car repairs. A record of all this material is carried through the charge-out book kept at the repair yard. This scheme has many advantages, and no disadvantages have been noted. It has reduced clerical work, saved time of foremen and workmen, and permitted the foremen to give to supervision the time formerly consumed in handling material orders.

A Conservative View of National Railroad Problem*

Merits and Faults of the Cummins Bill; Need of Specific Constructive Legislation

By Samuel Rea

President of the Pennsylvania Railroad

IT IS A PLEASURE to address those in charge of the savings banks for they have, through their guardianship and investment of the savings of our thrifty people, a substantial financial interest in the proper solution of the railroad question. The savings banks are the chief reliance of our people of small means who should not risk their savings, but should have them within convenient call at all times, and without hazard of diminution. I commend your faithfulness to the trust reposed in you by millions of our people. The investment of their money by you in safe and useful enterprises has been an important factor in developing our country and assisting its people to prosper. . . . The Senate and House committees have listened to about 50 plans; but I now hope we can soon close our talking season, and that Congress will adopt constructive railroad legislation that will recreate railroad credit. Today railroad credit is based not solely on railroad earnings but directly on the treasury of the United States, which is bad for the nation's finances and business, and a burden which increases its taxation. [The speaker here described the plan presented by the Association of Railway Executives, reported in the *Railway Age*, August 22, p. 353, and went on to explain its main features.]

Dangers of Fixing Maximum Returns

As a result of close contact with the railroad problem here and abroad and with the results of past experience of the national and state governments with public works and railroads before us, we felt that government ownership or a government guarantee was not desirable for the railroads of the country. In its last analysis a government guarantee means government operation, as, if the government is to supply the funds, it must have a controlling force in expenditures.

Although we realized our plan was not perfect, we avoided fixing a maximum return to all the railroads on their property investment, and a division of profits by individual companies if they exceeded that maximum, believing that any attempt to confiscate surplus earnings of any individual company would surely eliminate initiative, restrict competition and injure credit. Interest rates are exceedingly high compared to the pre-war period, and with the capital necessities of the world far from satisfied, any suggested maximum like 6 per cent would be too low for a period when the credit of the government itself, if left free from bank and treasury support, is nearly 5 per cent. The railroads have to raise about a billion dollars annually of new capital for improvements and equipment, as well as provide for maturing notes and securities, and may find 6 per cent insufficient for several years. The danger of maximum earnings may be illustrated by the experience of street railways. The five-cent maximum fare was regarded as providing a sufficient margin of profit to meet all conditions, but it has proved totally inadequate, so that public utility companies are as bad a problem for the country to adjust as the railroads. Many of us remember leases in which 60 per cent or 70 per cent of gross was considered an ample compensation to a lessee to operate a road but the lessees in most cases were later compelled to buy up the stocks of such roads and cancel the

leases, because 60 per cent or 70 per cent of gross proved insufficient to pay operating expenses; while the rent of 40 per cent or 30 per cent of the gross paid to the lessor, as earnings increased, became a bonanza.

From a long experience I distrust arbitrary maximum returns unless all other factors such as income, taxes, interest, etc., are likewise fixed, because we cannot foresee or control future business and financial conditions. I have more sympathy with specifying a minimum return as a guide to our commissions of what is an unreasonably low transportation rate and an unfair return on the investment low transportation rate and an unfair return on the investment, instead of relying on the courts to save the carriers from confiscation. I would consider a return of 6 per cent on the property investment a minimum return, especially now when money will cost the railroads even higher figures. Judging by past experience there did not seem to be the requisite authority or initiative in the commissions—federal and state—to make rates that would produce a return of even 6 per cent for a traffic district, or rate making group of railroads, except in years when the roads showed an unexpected expansion of business and when costs continued somewhat stationary, as in parts of the calendar years 1909 and 1916. I have been informed that a minimum would not be specified by Congress, unless it be an absurdly low return, like 4 per cent, upon which even the government itself has not been able to borrow the moneys it required.

Neither a maximum nor a minimum is required, if Congress will take the responsibility of directing the federal commissions to enable the railroads to resume business on a self-sustaining credit basis, and attract the necessary additional capital for improvements to properly serve the public. The railroads cannot serve the public if they continue on the "bread line."

The Cummins Bill

Now in response to all the testimony on the railroad question, and the various plans suggested, and the serious condition of railroad credit, a tentative bill, Senate 2906, has been introduced by Senator Cummins to solve our problem. It is the first broad, friendly legislative expression towards railroads in the last fifteen years. Therefore, I propose to briefly and, I trust, constructively, review some of its salient features, with the expectation that Senator Cummins will not consider the railroads and their owners ungrateful for the work he and his committee have tried to do for the country, but with the sincere hope that he and his associates will endeavor to correct some features of the bill.

The indebtedness of the roads to the government for capital expenditures made during federal control certainly ought to be funded for not less than ten years rather than five years, considering financial conditions generally, and the annual requirements for capital by the railroads. For general indebtedness, some security other than demand notes should be provided, otherwise credit will be imperiled rather than helped by such funding. The government should leave the railroads in at least as sound physical and financial condition as when they were taken over. Merchants, farmers and others have been protected by higher prices, but the railroads were not placed in that position; and they should not be asked

*An address before the savings bank section of the American Bankers' Association, at St. Louis, Mo., October 1. Abridged.

to pay the large capital expenditures of the war period without assistance from the government to fund them for a long period and at low interest rates. These capital expenditures were made to assist in protecting the life of the nation, and the roads should also have transportation rates sufficient to hereafter sustain them. [The speaker here enumerated certain features of the bill which are accepted as beneficial or which at least were subjected to no unfavorable comment; exclusive federal regulation of securities; new rates to be suspended only five months instead of ten; creation of a transportation board; better definition of the elements to be considered in prescribing a rate; prevention of strikes; pooling; commission to prescribe minimum rates.]

Objectionable Features—Cummins' Bill

Some of the objectionable features are:

The Interstate Commerce Commission is not given effective authority over intrastate rates. Without this authority how can the Commission and the transportation board fully protect railroad credit? The provisions as to making compensatory rates and permitting a return sufficient to maintain railroad credit and provide adequate facilities are not sufficiently definite and mandatory to produce that result. The labor provisions are too diffuse to be effective. The purposes for which voluntary consolidations can be made, are too restrictive in their scope and the provisions as to compulsory consolidations are fatal to railroad credit. The commandeering of the so-called excess earnings of individual companies, and penalizing surplus earnings if used to provide better railroad facilities, is a decided blow to operating initiative and conservative financing. Railroad valuation in its present form cannot be used for the various purposes proposed in the bill, nor can it be completed to enable the Commission or the carriers to promptly carry out the various provisions of this proposed law.

Valuation

The valuation found by the Interstate Commerce Commission, under the present law, is claimed by the government to be a valuation only for rate making purposes, but this bill requires the same valuation to be used for rate making, capitalization, consolidation, and the measure of a fair return, or as a selling price of the property, and apparently the commission may change that valuation from time to time. To wait for the final valuation will cause great delay and any intention of its use for all of these purposes is bound to be disappointing. Therefore, rather than stop all progress in fixing reasonable rates, let the existing records of "property investment" be used pending final valuation. It is the return on the property investment of a traffic district that is a guide to the Commission in rate making, and not that of single companies; and so far, in those districts, the return has been found too low for sound railroad credit.

Authorization of Betterments

The bill provides that the right of eminent domain cannot be exercised without a certificate of the Transportation Board and the Interstate Commerce Commission for acquisition, construction, maintenance or operation purposes, or any authorized extension or addition; but authority to proceed with any new construction is divided between the states and the federal commissions. The construction of a new line of railroad or extension must be authorized by the Transportation Board; but this Board is specifically excluded from authorizing the construction of side tracks, spurs, industrial, team or switching tracks located wholly within one state—for that the railroads must apply for state authority.

The question of branches and terminals does not seem to be very accurately defined. This serious question is further tied up by the approval of the issuance of securities, to carry out such work, being solely under federal authority. There-

fore, I regard the provisions for carrying on improvement work and exercising eminent domain under such divided federal and state authority as detrimental to business. Industries cannot defer the establishment or extension of their plants on such a divided and dilatory process. The entire responsibility for authorizing the acquisition of all additional right of way or terminal areas, as well as all new capital expenditure work, should at least be concentrated under one board, just as this issuance of securities is to be solely under the Interstate Commerce Commission. When improvements are so authorized, no public benefit is secured by requiring the consent of any governmental body to the exercise of the power of eminent domain. The requirement of such consent would mean delay and enhanced cost.

Labor Provisions

The labor provisions of the bill primarily concern not only the management and investors but the welfare of 1,900,000 employees; and may affect the payment of \$2,800,000,000 in wages. The final decision on railroad wages is given to the Transportation Board. No qualifications are stated for the members of this important board, which is to deal with the operating and administrative questions of all the railroads, including wages. Subordinate to this board is a committee on wages and working conditions, consisting of eight members, four to be selected from the persons nominated by the organized railroad working crafts on each railroad to represent labor, and four from among the persons nominated by all the railroad corporations; and I suppose the Transportation Board is expected to represent the public. Four years is the term of office and \$4,000 each the compensation of the members of the committee on wages and working conditions. Unless this committee is expected to pass all disputes to the transportation board, surely that short term and that salary are insignificant compared to the magnitude of this responsibility, which has tested the ability of the President and the director general, and the railroad managers. For that task the best railroad managers, who understand social questions as well as operating questions, are needed, and the labor members must be up to the same standard. Any suggestion as to standard wages that takes no account of the varying living costs and conditions as between New York, Florida, California, Kansas and Maine is contrary to economic experience. No equitable plan for the avoidance of future disputes as to wages will be complete or protective against strikes, unless a sliding scale is adopted, whereby wages will be adjusted to living costs. Settlement of wages under pressure or as a compromise, is bound to produce dissatisfaction.

A further labor proviso is that on the board of directors of each carrier there shall be two labor directors and two government directors after June 30, 1920. The two labor directors shall be selected from the classified employees and nominated by the employees. The two government directors are to be appointed by the transportation board, and apparently whether satisfactory or unsatisfactory to each corporation. On all committees of the corporations' boards there shall be at least one labor director and one government director. These labor and government directors are to be compensated and their expenses paid by the corporation for attending board and committee meetings. There is nothing to show whether they are to be on the two thousand or more railroad boards of the country, or only on the boards of the operating carriers. Wages and working conditions are to be settled by the committee on wages and working conditions and by the transportation board in Washington so that no individual carrier corporation will have any responsibility for wages. Further, no carrier can prescribe the wages of its own employees independent of other railroads. Therefore, these labor and government directors on the board of directors of every carrier corporation seem to be like the fifth wheel of a wagon.

They have no prescribed responsibilities or qualifications, and nothing is said as to the responsibility of the government for their votes.

Looking for the results to be expected from the two government directors, the bill does not permit railroad companies to make capital expenditures, to exercise the power of eminent domain, or to issue securities except upon government approval. What useful service, therefore, will these two government directors render? If these four directors, instead of sitting on the carrier's board of directors, could be elected one-half by the carrier and one-half by the employees and work as subordinates to the committee on wages and working conditions, they might give a touch of home rule to the labor question, and form a thread of a labor organization, starting from the local ground and ending with the transportation board, which might be of some benefit. This is a suggestion and not a solution of the railroad labor question but it indicates the necessity for careful revision. It would appear wiser to let the transportation board, which has final responsibility for wages and for governmental supervision of the railroads, direct how employees and corporations and the public shall be represented, and avoid prescribing elaborate machinery.

There is another labor provision, *i. e.*, an employees' advisory council selected from each organized craft of railroad employees requesting representation, to administer a fund consisting of one-half of any excess earnings over a fair return, which any company guilty of that rare offense under a system of rates which must be reasonable and uniform, shall pay over to the transportation board. This duty might very easily be performed by the committee on wages and working conditions or the transportation board and this advisory council be dispensed with.

Consolidation of Roads Into Competitive Systems

I am in favor of consolidation. The bill declares it is the policy of the United States to divide the railroads into not less than 20 nor more than 35 separate and distinct systems—this division to be a division in ownership and for operating purposes. Each of the systems is to be owned and operated by a distinct corporation and, where practicable, the existing routes and channels of trade and commerce are to be maintained. The systems are to be so arranged and equalized as far as practicable, that uniform transportation costs, uniform rates and the same rate of return on value may be earned. The transportation board is to devise and adopt the system plans, but may thereafter change them. The Interstate Commerce Commission must also approve them. The government will have no financial responsibility for their formation either in the voluntary consolidation plans, or in those regional companies to be mandatorily formed after seven years by order of the transportation board. The arresting of the law of gravitation would be as easy to accomplish as to arrange and maintain these ideal systems, considering the divergent traffic conditions, physical, financial and other conditions of the various roads in even a single traffic district.

If anything is calculated to stop consolidations, and make them impossible to finance, it is a railroad alinement of this arbitrary character. The existing systems have been formed under a competitive system and follow the lines of the natural traffic routes, and are feeders and extensions of the original trunk lines, and in that way became attached to them as systems. Others might be formed gradually on similar lines, and as their organizations could be trained for the enlarged responsibilities.

The necessity for absorption, merger and consolidation of smaller corporations is apparent. In the last complete Interstate Commerce Commission report, that for the year ending June 30, 1916, we find 1590 companies divided into the following classes: Class I, 189 railroads; Class II, 276 rail-

roads; Class III, 431 railroads; Switching and terminal companies, 227; Lessor companies, 467. These 1590 companies do not include about 600 roads that are privately owned, or industrial lines not common carriers, some of which report only to state commissions. The 189 first-class roads, together with their lessor companies, earned 97.4 per cent of the total operating revenues of the country. Now taking 162 of the chief operating companies, which earned 94.6 per cent of the total operating revenues of the country, we find that they already constitute 86 systems. But only 18 systems during the three-year test period earned over 6 per cent on their property investment. . . . Until earnings are increased, it is hard to see the basis on which the railroads can proceed with any wholesale plan of absorption or consolidation. The 86 systems existing can be reduced, not arbitrarily, but as traffic and earnings justify. Indeed, as 23 systems already handle about 80 per cent of the total operating revenues, there seems to be no necessity or benefit to be obtained from constituting, valuing and financing new systems arbitrarily put together. . . .

What the railroads need is not an arbitrary division of the country into 20 or 35 distinct systems formed by mandate of the federal government and the changing views of various boards or commissions; nor any attempts to tie the weak and the strong together, in the hope that in some way or other the few strong railroads of the country can support the weak lines, including lines that have thin traffic or should never have been constructed. The railroads want laws that will permit the existing railway systems to absorb and eliminate the affiliated companies now owned, operated, leased or affiliated with their systems. Such further connecting roads may be added as may be required to round out these systems on a basis that would be approved by the federal commissions.

In the Pennsylvania system there are about 140 live companies, consisting of railroad companies, ferry companies, bridge companies, water companies and warehouse companies—all essential for transportation purposes. They are leased or operated, wholly owned, or owned in part by the parent company. Therefore, an absorption law to clear up the barriers in the existing charters and divergent state laws that prevent the absorption of such affiliated companies, to round out a single system and leave the name and securities of the parent companies unchanged, seems desirable. No such absorption of small companies by the large systems can proceed on any large scale without reasonable earnings to enable that course to be pursued, and thereafter leave the system in a strong position to do its financing on reasonable terms.

The big systems have absorbed many weak lines, and are now supporting other weak lines, and they have about reached the limit in that respect.

At the conclusion of federal control the bill states that rates are to remain in effect until changed by competent authority. This means state as well as federal. You can see what a hopeless state of confusion will be caused by throwing all the states into rate regulation again. The carriers are to file new schedules of rates, fares and charges with the commission within thirty days after federal control terminates, the same to become effective four months after they have been filed. During this period of readjustment, but for not exceeding five months, the compensation under the federal control act is to be guaranteed. During the calendar year 1917 it took about 75 cents out of every dollar to pay operating expenses and taxes, and now it is costing over 90 cents out of every dollar. Certainly for this period of reconstruction, affecting the entire nation, the United States government should readjust all rates—state and interstate—to meet the transportation costs, and properly establish railroad credit, by exercising the same control over rates as was done during federal control. It is true that the bill authorizes the Interstate Commerce Commission to co-operate with the state commissions and remove any unreasonable discrimination

against interstate and foreign commerce, but the act specifically states that it does not amend or affect the existing state laws or powers in relation to taxation or the lawful police powers of the several states, including the power to make and regulate intrastate rates, except as in the act otherwise provided. It will, therefore, be seen that such reservations will produce extensive proceedings or controversies so as to delay justice to the carriers, or to other states that may be affected by the rates made in a single state. It also divides the responsibility as to the credit of the carriers. The declarations of policy and elements affecting reasonable rates should be made so mandatory that the federal commissions should have a positive duty to see that the rates, both state and interstate, are adequate to protect that credit.

The Cummins bill as it stands, gives us no definite or prompt assurance of adequate rates, nor does it get us away from conflicting state regulations. To make it a truly constructive measure it must be strengthened and amended in these fundamental particulars.

Commandeering of Earnings

The provisions relative to commandeering and using for other railroad companies and for railroad employees the so-called excess earnings of individual companies will throw many railroad investments again into a condition of uncertainty, because a fair return is not prescribed or defined. What may be a fair return for one company, and for one year, may at the lapse of the next year be reversed by the commission, or be varied for other companies. There will be no incentive to any carrier to earn any money in excess of the payment of an ordinary dividend, not only because of the confiscation of the so-called excess earnings, but the further provision that any surplus earnings invested in the property cannot be capitalized or used as a basis for increased returns. These provisions will force all future additions, betterments and improvements to be provided from the issue and sale of securities. Such provisions would terminate conservative financing, as under private ownership, the money for new improvements could be had only from the sale of bonds under these conditions, and at higher interest rates to accord with the risk of bad years. If this system is once established for the railroads, it will in time be applied to all public utility companies at the outset, and later to industrial and manufacturing concerns, because their products are just as essential for the daily life of the citizen as railroad transportation.

I desire to emphasize the fact that the conservative railroads which have successfully weathered the various panics, industrial and financial, here and in England, without wiping out or reducing their dividends, are those railroads which used their surplus over reasonable dividends to provide additional facilities and equipment for the public use, instead of selling stocks or securities for that purpose. The Pennsylvania system is a fair example. Its property cost and marketable securities, not including holdings of securities of companies forming part of the system, exceeds the total outstanding securities in the hands of the public to the extent of over \$500,000,000. If the company instead of following that practice had distributed all its yearly surplus in dividends, and had sold securities for all additions and betterments to its property and equipment, it would now require \$30,000,000 per annum of additional net income to pay its 6 per cent dividends; or the company's stock would have been reduced to a 4 per cent dividend, and its bonds would have had to carry a much higher rate of interest because of weaker credit. It would have been impossible for it to have sold its stock on the market, and that would have been to the detriment of the country and industry, as well as to the company's security holders and owners.

The company's surplus was not derived from excessive transportation charges. These charges have been materially

below those authorized by its charter. The freight charges especially were materially reduced from the beginning of operation, about seventy years ago, to within recent years, and almost ruinous competition among the various roads had a great effect in reducing these charges. The surplus for improving the company's credit and property was obtained not only from moderate profits in the transportation business, but by paying low dividends on its stock for a long series of years, from selling its stock at premiums, and from profits realized on its investments. This surplus was invested in the property for the improvement of the same for the public use, when legitimately it might all have been disbursed in dividends to the stockholders.

This practice was also followed by other companies without any regulation or legal requirements, and the public was benefited. What I object to is: (1st) the reprehensible feature that what a company earns under fair and uniform rates through good management and efficient transportation can be taken from it and given to others, thereby sapping the spirit of initiative and competition, and (2nd) federal regulation that ultimately will create a situation in which no surplus earnings over a fair return can exist, and that absolutely penalizes the railroads if they invest any surplus earnings in the property for the benefit of the public. If these provisions are allowed to stand, then the least I can ask is that an allowance of some surplus over a fair return in good years should be made mandatory, and not permissive, to assist in lean years. Otherwise in bad years, rates would have to be increased when shippers could least afford to pay them.

If the Pennsylvania Railroad Company after paying its fair dividends is not to have a surplus to sustain the credit and operations of weak roads in its system, then several hundred miles of railroads must stop operations and improvements, and communities must suffer.

The Pennsylvania system represents about 6.5 per cent of the whole track mileage of the country, about 13 per cent of the ton mileage, and 13.5 per cent of the passenger mileage. Its track mileage is about one-half of that of Great Britain and Ireland, and it has invested for public use \$1,800,000,000, in its road and equipment, approximately one-tenth of the whole railroad investment of this country. It has been opened for traffic 67 years, and during that time its management has observed a sane and conservative financial and operating policy, and dealt generously with labor in wages and welfare funds to the extent the earnings permitted. I have the honor of having served the company, with the exception of a few years, since 1871, and for over 30 years have been closely associated with the executive department, familiar with the construction of new lines and branches to serve the public and the financing, upbuilding and compacting of the system. Therefore, I can speak intelligently, and indeed feelingly, about the company's policy and affairs. So far as public regulation is concerned, for the last ten years the company has not been allowed sufficient revenues to earn 6 per cent on the cost of its property and equipment except in 1909 and 1916. Yet so far as the management is concerned, long before there was any regulation of the railroads, as we now understand it, the Pennsylvania Railroad Company did not distribute all of its net income in dividends, but judiciously applied a substantial portion to promoting, helping and upbuilding its feeders and connecting lines, to eliminating grade crossings, and for other similar construction items. It was not alone in this policy. Other companies pursued the same course, and they could be depended upon to continue such policies, under proper regulation, without injustice to the public. Then why must Congress now propose, as a future national policy, to confiscate their so-called surplus earnings and stop incentive, and on the other hand fail to definitely order reasonable rates that must produce a fair return upon which railroads can live and make progress?

The Problem and the Remedy

The railroad problem has not changed, nor is it shrouded in mystery. It is this: Railroad earnings and credit must be created sufficient to support the existing railroad investment and attract the additional capital the transportation business requires in the public interest. New capital cannot be commandeered. Therefore, adequate rates made under public approval, with opportunity for competition, initiative and incentive, is the effective remedy for the whole problem, in my opinion. If adequate rates had been granted in the past decade, there would not have been a railroad problem. I desire to see the Cummins bill amended to definitely accomplish that result. If that mandate is not positively forthcoming as the result of the new legislation, all the boards and machinery created for regulatory purposes will be useless. Extreme care must be exercised to insure sound credit, and not theorize about it. If public regulation does not allow earnings sufficient to sustain railroad credit, and provide necessary transportation facilities, the public will be forced to regard regulation as a huge waste of money, time and effort, and demand a simplification of the situation, and start with a new slate, or drive straight for government ownership with its train of higher costs, inefficiency, and political domination of the employees and of the industries depending on the railroads. National reconstruction cannot be accomplished while railroad investments and credit are left in an unsatisfactory condition. This should spur Congress, the commissions, the investors, the employees, railroad management, and the public to work together for an equitable and prompt solution of this great problem. To that end the railroad executives are prepared to devote their whole time and attention, if the Congressional committees so desire. Further delay is extremely dangerous to all concerned.

Cost of Freight Train and Locomotive Service in August

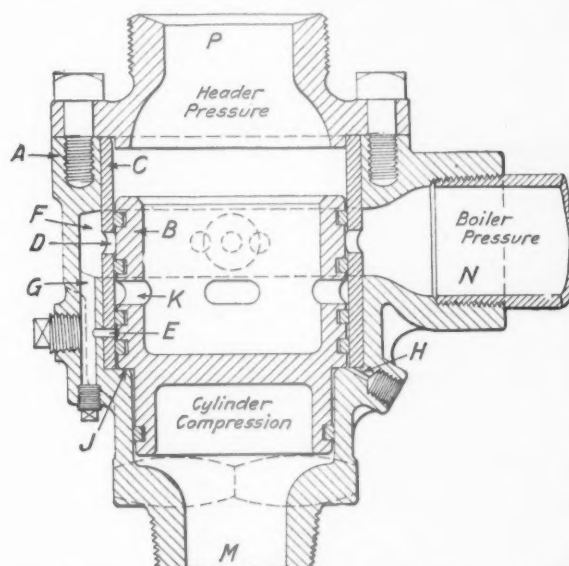
THE TOTAL COST of freight train service per 1,000 gross ton miles in August was 99.5 cents, according to the monthly report of the Operating Statistics Section. This is the lowest point it has reached this year and compares with 101.1 cents for August, 1918, a decrease of 1.6 per cent. In July it was 100.6 cents. Per mile, however, the costs are still greater than last year. The cost of freight locomotive service per locomotive mile in August was 103.2 cents, which is an increase of 1.5 per cent as compared with August, 1918, when it was 101.7 cents. In July it was 104.8 cents. The cost of freight train service per train mile in August was 152.8 as compared with 149.8 cents in August, 1918, an increase of 2 per cent. In July it was 153.8 cents. The items of locomotive repairs and fuel show decreases. The combined figures for all regions and the comparative figures for last year are as follows:

	August	
	1919	1918
Cost of locomotive service per locomotive mile.....	103.2	101.7
Locomotive repairs	32.3	33.6
Enginehouse expenses	8.3	7.0
Train enginemen	20.2	19.0
Locomotive fuel	39.1	39.2
Other locomotive supplies.....	3.3	2.9
Cost of train service per train mile.....	152.8	149.8
Enginehouse expenses /	46.3	46.8
Locomotive repairs	44.6	45.3
Locomotive fuel	3.8	3.4
Other locomotive supplies.....	23.0	21.9
Train enginemen	26.5	25.6
Trainmen	8.6	6.9
Train supplies and expenses.....	99.5	101.1
Cost of train service per 1,000-ton miles.....	30.1	31.6
Locomotive repairs	29.1	30.5
Enginehouse expenses /	2.5	2.3
Locomotive fuel	32.2	32.1
Other locomotive supplies.....	5.6	4.6
Enginemen and trainmen.....		
Train supplies and expenses.....		

Ripken Automatic Drifting Valve for Locomotives

SINCE SUPERHEATED STEAM has come into general use the trouble experienced with deposits on locomotive pistons and cylinders has increased greatly. The use of the drifting throttle has proved effective in eliminating this trouble, but it is difficult to insure that the engineer uses the proper amount of steam and for that reason an automatic drifting valve has important advantages over the drifting throttle. Several types of drifting valves are in use at present, the majority being arranged to come into action when a vacuum is formed in the cylinder. Since the vacuum which operates the valve will also draw in the front end gases which cause deposits on the cylinder walls, any drifting valve operated on this principle cannot entirely remove the trouble.

In order to do away with the formation of a vacuum in the cylinder, a valve has been devised which is operated by the compression in the cylinder. This device is known as the Ripken automatic drifting valve and is in use on the Minneapolis, St. Paul & Sault Sainte Marie. The valve



Section Showing the Connection of the Ripken Automatic Drifting Valve

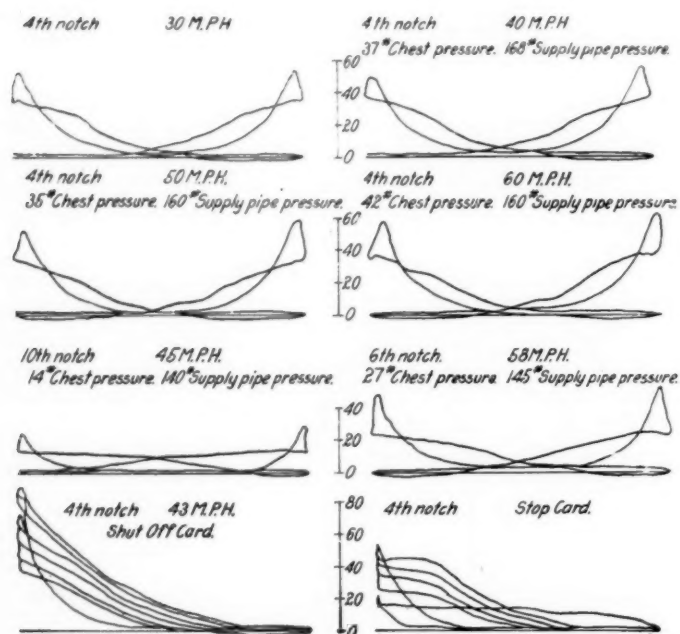
comes into operation before the cylinders are emptied of steam pressure after the throttle has been closed and is kept in operation and furnishes the needed amount of steam until the pistons cease to move. It is automatically closed just as the engine stops by the building up of pressure in the steam chest.

Only one valve per engine is used as the steam is passed directly to the branch pipe or the saturated end of the superheater header. This arrangement is advantageous as it reduces the amount of steam required and also protects the superheater elements against overheating. It is unnecessary to use either air relief valves or by-pass valves in conjunction with the Ripken drifting valve.

One illustration shows a section of the valve which serves to illustrate its operation. The operating portion consists of a cage A, and a differential piston valve B. The cage has an opening M at the bottom which is connected by the most direct means possible with one end of the cylinder so that the cylinder pressure is transmitted to the lower side of the piston. The side opening N, is connected through a two-inch pipe to a live steam line from the turret. The opening P at the top of the valve communicates with the branch pipe or superheater header.

Within the cage *A* is a bushing *C*, in which are ports *D* and *E*. The port *D* is surrounded by a duct *F*, which is always filled with live steam. From the duct *F* live steam passes through the passage *G* to port *E*. At the lower end of the bushing *C* is a small regulating and relief port *H*, connected by piping to the exhaust chamber of the locomotive.

When the main throttle is closed the pressure on top of the differential piston *B* falls and the compression in the cylinders acting on the bottom of the valve being in excess of the steam chest pressure raises the valve *B* off the shoulder *J*, upon which it normally rests, placing the port *K* in communication with port *D*. This permits steam to flow through the valve into the steam chest maintaining the required pressure to prevent a vacuum while drifting. The raising of the valve also uncovers port *E* and the steam entering the annular cavity under the valve is restricted by the port *H* and furnishes the counter pressure necessary to hold ports *D* and *K* in communication until the engine is almost at a standstill. As the speed decreases the pressure in the steam chest will rise, and overcoming the pressure on the bottom of the differential valve, will force the valve



Typical Indicator Cards from an Engine Fitted with the Ripken Drifting Valve

to its seat, where the fraction of the rings will hold it closed. Any slight leakage past the lower rings is taken care of by the port *H* and it is, therefore, practically impossible for the valve to open while the engine is at rest.

Tests on a superheater locomotive with 25 in. by 26 in. cylinders supplied with steam from a two-inch pipe showed that the valve when adjusted to close at about 40 lb. per sq. in. would maintain between 25 and 30 lb. pressure in the steam chest at 25 per cent cutoff at a speed of 60 miles an hour, preventing the formation of a harmful vacuum even at such high speed. After a shut-off with the reverse lever in running position, the valve would open when the steam chest pressure dropped to about 30 lb. The valve would close again when the steam chest pressure rose to 40 lb. which occurred just before the stop, allowing time for the superheater to empty itself before the engine came to rest. The Ripken drifting valve has been in use nearly two years with excellent results. It has required little attention and has prolonged the life of cylinder and piston rod packing on the engines to which it has been applied.

Cost of Freight Train and Locomotive Service in July

THE TOTAL COST of freight train service, including locomotive service, continues to show a steady decrease each month as compared with preceding months, although increases as compared with last year, according to the monthly report of the Operating Statistics Section. For the month of July it was 100.6 cents per 1,000 gross ton miles, as compared with 101.8 cents in June, 103.9 in May, 112.7 in April, 119.5 in March and 126.5 in February. No comparison of this figure with last year is given. The cost of freight locomotive service per locomotive mile in July was 104.8 cents, as compared with 98.7 in July, 1918, an increase of 6.2 per cent, and as compared with 107.1 cents in June of this year. The cost of freight train service per train mile was 153.8 cents, as compared with 144.2 cents in July, 1918, an increase of 6.7 per cent, and as compared with 154.7 cents in June. All items of cost continue to show increases as compared with last year, except locomotive fuel, which for July shows a slight decrease.

	July					
	1919	1918	1919	1918	1919	1918
Cost of locomotive service per locomotive mile.....	104.8	98.7	104.8	98.7	104.8	98.7
Locomotive repairs	35.6	32.3	35.6	32.3	35.6	32.3
Enginehouse expenses	8.3	7.0	8.3	7.0	8.3	7.0
Train enginemen	19.8	18.5	19.8	18.5	19.8	18.5
Locomotive fuel	37.7	37.9	37.7	37.9	37.7	37.9
Other locomotive supplies	3.3	2.9	3.3	2.9	3.3	2.9
Cost of train service per train mile.....	153.8	144.1	153.8	144.1	153.8	144.1
Enginehouse expenses	50.1	45.3	50.1	45.3	50.1	45.3
Locomotive repairs	43.0	43.6	43.0	43.6	43.0	43.6
Other locomotive supplies	3.8	3.4	3.8	3.4	3.8	3.4
Train enginemen	22.6	21.3	22.6	21.3	22.6	21.3
Trainmen	26.1	24.8	26.1	24.8	26.1	24.8
Train supplies and expenses	8.2	5.9	8.2	5.9	8.2	5.9

Cost of train service per 1,000 gross ton miles.....

Locomotive repairs

Enginehouse expenses

Locomotive fuel

Other locomotive supplies

Enginemen and trainmen.....

Train supplies and expenses.....

July, 1919

June, 1919

May, 1919

April, 1919

March, 1919

Feb'y, 1919

100.6

101.8

103.9

112.7

119.5

126.5

32.7

33.7

35.4

38.6

40.8

43.1

28.1

29.3

30.6

34.3

37.5

40.3

2.5

2.6

2.6

2.9

3.1

3.4

31.9

31.5

31.1

32.4

33.5

34.8

5.4

4.7

4.2

4.4

4.6

4.8



From the Omaha Bee

More McAdoodle

General News Department

Profane language, or anything repugnant to the clause in the rule-book calling for "the faithful, intelligent and courteous" discharge of duty may afford good cause for dismissal from the railroad service. This is the salient feature of a circular recently promulgated on the Pennsylvania Railroad. Already, according to a local paper, a number of employees on the Middle Division have been suspended for using foul and profane language.

Cars were not held at Louisville for whiskey; so says Director General Hines. In accordance with shippers' orders, instructions were issued to furnish cars for such shipments on December 8, "consistently with the performance of other transportation requirements," if the ban of the law should be lifted by the court; but cars were not held idle for that purpose. No decision having been made by the court, these orders were rescinded and no cars are being held.

Three thousand is the number of empty freight cars said to have been standing on side tracks in and near Louisville, Ky., last Monday morning, held in the expectation that by an anticipated decision of the Supreme Court, but which was not handed down on that day, the cars could be used to carry off 36,500,000 gallons of whiskey which distillers in that region are anxious to dispose of before the constitutional prohibition of liquor traffic goes into effect. Plans had been made to load the whiskey into the cars as fast as the revenue stamps could be pasted on the barrels. Whether or not any one is paying demurrage on these cars at the present time, while the decision of the Supreme Court is breathlessly awaited, is not stated.

Contracts Executed

The Railroad Administration has executed compensation contracts with the Maine Central for \$2,955,696, the Hocking

Valley for \$2,637,167 and the Atlanta, Birmingham & Atlantic for \$480,000.

Passengers Burned to Death at Muscatine, Iowa

In the derailment of a gasoline motor car on the Muscatine, Burlington & Southern, three miles south of Muscatine, Iowa, on the evening of the 4th of December, three persons were burned to death, and 13 or more were injured, every occupant of the car being either killed or injured. According to the Des Moines Register, the car was thrown off the track by a defective rail which had already been reported; the gasoline tank was punctured, when the car fell on its side, and the gasoline took fire. The only available exit from the car was a side door, which was on the side next to the ground, and, because of the rapidly spreading flames, passengers struggled in vain to escape, until a man broke a window in the rear end. Some of the escaping passengers were burned.

The Muscatine, Burlington & Southern extends from Muscatine, Iowa, southward 54 miles to Burlington. The timetable in the Official Guide shows four trains each way on week days, marked "motor car," and one other train each way.

Railway Revenues for October

The Interstate Commerce Commission has issued for October its regular compilations of revenues and expenses of class I roads (186 railroads and 17 switching and terminal companies). Net operating income for October, 1919, was \$86,523,011, and the average per mile of road operated was \$369. This compares with \$428 per mile for the month of October in the years 1914, 1915 and 1916, included in the "test period."

The details are shown in the large table.

Railway Revenues and Expenses for October and Ten Months

	October		Per mile of road operated		Ten months		Per mile of road operated	
	Amount				Amount			
	1919	1918	1919	1918	1919	1918	1919	1918
1. Average No. miles operated	234,122.45	233,895.90	.....	.....	233,933.37	234,301.78	.....	.....
<i>Revenues.</i>								
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
2. Freight	368,502,283	365,427,509	1,574	1,563	2,949,628,666	2,825,972,062	12,609	12,061
3. Passenger	98,863,902	84,803,839	422	363	985,900,632	857,852,148	4,214	3,661
4. Mail	4,529,077	4,276,597	19	18	43,445,495	44,709,901	186	191
5. Express	13,313,006	12,693,162	57	54	96,865,254	102,675,749	414	438
6. All other transportation	11,918,997	11,981,695	51	51	104,972,471	105,604,973	449	451
7. Incidental	12,175,870	11,259,405	52	48	108,094,751	103,780,601	462	443
8. Joint facility—Cr.	614,829	524,566	3	2	5,679,106	4,841,659	24	21
9. Joint facility—Dr.	199,399	148,537	1	1	1,783,282	1,460,035	8	8
10. Railway operating revenues.....	509,718,565	490,818,236	2,177	2,098	4,292,802,493	4,043,977,058	18,350	17,260
<i>Expenses</i>								
11. Maintenance of way and structures.....	72,431,070	63,899,868	309	273	647,553,193	523,527,059	2,768	2,234
12. Maintenance of equipment	115,842,669	119,042,501	495	509	1,003,341,842	899,165,368	4,289	3,838
13. Traffic	4,014,623	3,468,841	17	15	38,899,772	42,090,541	166	180
14. Transportation	198,729,930	185,718,022	849	794	1,786,973,450	1,671,392,303	7,639	7,134
15. Miscellaneous operations	4,440,912	3,288,638	19	14	40,095,812	32,152,884	171	137
16. General	10,809,293	9,615,317	46	41	103,520,234	92,315,169	443	394
17. Transportation for investment—Cr.....	457,260	579,095	2	2	4,943,745	4,690,018	21	20
18. Railway operating expenses	405,811,237	384,454,092	1,733	1,644	3,615,440,558	3,255,953,306	15,455	13,897
19. Net revenue from railway operations.....	103,907,328	106,364,144	444	454	677,361,935	788,023,752	2,895	3,363
20. Railway tax accruals (excluding "war taxes").	17,281,136	16,591,369	74	71	158,196,921	157,257,833	676	671
21. Uncollectible railway revenues	103,181	52,293	1	....	666,879	517,586	3	2
22. Railway operating income.....	86,523,011	89,720,482	369	383	518,498,135	630,248,333	2,216	2,690
23. Equipment rents (Dr. Bal.).....	8,924,486	1,243,169	38	5	24,947,788	11,332,295	107	48
24. Joint facility rent (Dr. Bal.).....	1,201,312	1,124,028	5	5	12,467,816	11,705,360	53	50
25. Net of items 22, 23 and 24.....	76,397,213	87,353,285	326	373	481,082,531	607,210,678	2,056	2,592
26. Ratio of operating expenses to operating revenues, per cent.....	79.61	78.33	....	....	84.22	80.51	....	....

Foreign Railway News

Reports from Trieste say that freight rates on the Austrian State Railways, as well as on the private railways in Austria, were increased 150 per cent on October 15.

The Irish Railway Executive has had its attention drawn to the fact that a link line between the city terminus of the Cork & Macroom Railway and the Bandon & South Coast Railway, which was constructed for military purposes during the war, might now be utilized for commercial purposes with great advantage to the public and a manifest economy in labor and expense. The executive has been asked by the local authority to make such arrangements as may be necessary to adapt the link for commercial purposes.—(Modern Transport).

Automatic Signals in Australia

The Queensland government railway has installed a 4½-mile section of 3 position upper quadrant automatic signals.

LONDON.

Electrification in Bolivia

The Government of Bolivia is studying the problem of the electrification of the railroads and has declared as public domain the waters of the rivers having sufficient power for that purpose.

Raising of Rates on Uganda Government Railway

LONDON.

The proposal to raise the rates on the Uganda Government railway by 40 to 70 per cent, according to distance, is to be suspended, says the Engineer, pending further consideration.

Proposed Connection of India and Burma by Railway

LONDON.

The Times Trade Supplement states that sanction has been given to a preliminary survey by State engineers for a meter gage railway line by way of Hukong Valley to connect India and Burma. This will connect the existing line to Lakhimpur with the line from Mandalay along the Upper Irrawaddy valley.

Wood Fuel on Swiss Railways

LONDON.

The Times Trade Supplement states that the results obtained from the use of wood fuel in Switzerland, are of considerable interest. The technical difficulties were not so great as were anticipated. On lighting the fires with one cubic meter of wood a steam pressure of from five to six atmospheres was obtained in 1½ hours, for which otherwise 300 kilos of coal would have been required. The cost was only £1:12:0, or approximately

\$13 (pre-war rate), as against £2:18:4, or approximately \$15 (pre-war rate) with coal. The same maximum driving rates were obtained as with coal. The difficulty for storing fuel for long journeys was met by running a special truck behind the engine.

A Car Renting Scheme in Czechoslovakia

Several important Bohemian banks have formed a ten million crown company for the renting of freight cars under the name of Tschechoslovakische Wagonleih-A. G. Negotiations will be taken up with foreign car manufacturers. The cars will be purchased outright and rented only to such industrial undertakings as are stockholders and in proportion to the amount of stock they hold.

Oil Fuel in France

Press despatches from Paris dated November 27 say that on the day preceding the first locomotive on a French railroad to use oil as fuel was sent out on an experimental trip yesterday and hauled a heavy train with complete success. It is announced that railroads in France have planned to alter their engines so as to use oil fuel instead of coal, and that 200 locomotives may be thus changed.

German Railway Contracts

LONDON.

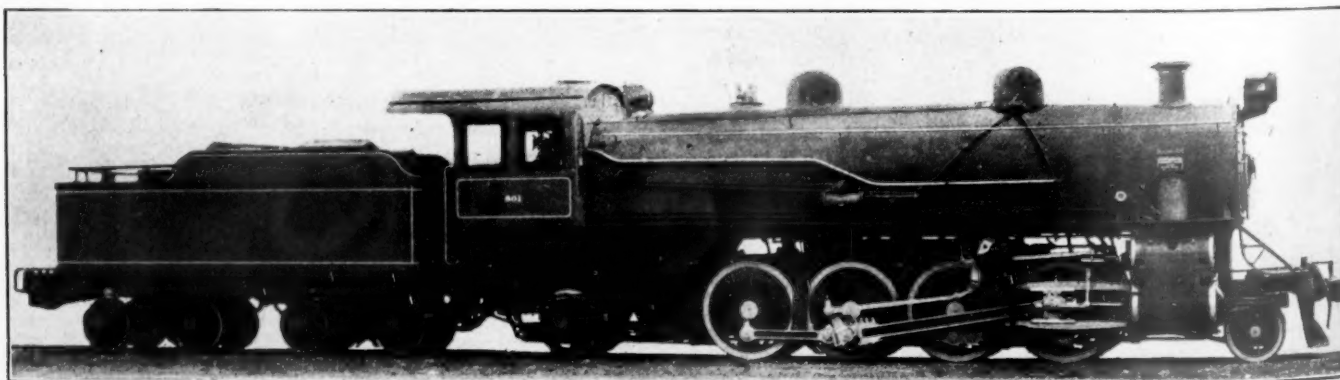
An extract by Modern Transport from the Koelnische Volkszeitung states that the German government has given Krupps a contract for the manufacture and delivery of 100 locomotives and 2,000 fifteen-ton freight cars per year. Full details of this contract are not yet known, but it is reported that the price to be paid will be based upon the actual cost of the material used and of the labor, and that the manufacturers themselves will only be allowed a commission profit of 2 per cent. It is also stated that directly after the armistice, Krupps converted two of its munition factories into rolling stock factories, and these two factories have a total capacity of 300 heavy locomotives and 2,500 fifteen-ton freight cars per year.

New Trans-Balkan Railway

LONDON.

An extract from the Times Trade Supplement states that the completion of a new railroad to run from Valona on the Adriatic to Monastir will not only benefit the undeveloped country of Albania, but will give Italy through communications across the Balkans with Constantinople. The efficiency of the railway will further be increased by two ferries which will carry the train over the Otranto Canal. Thus the Italian system will be linked up with the new railway.

It is also proposed to link up Durazzo, the most important port of Albania, by a branch which will run in an almost straight line through the plain of Kavaja along the old Roman road, via Egnatia. After diverging from this road and taking the Musekeja road, it will join the Trans-Balkan not far from Pekini, at a suitable spot between Fieri and Berat.



Mikado Locomotive for the Korean Government Railways

One of 12 locomotives recently built by the American Locomotive Company. These locomotives are for 4 ft. 8½ in. gage. They have 25 by 28 in. cylinders; 57 in. driving wheels; a total weight in working order of 210,000 lb.; a weight on drivers of 158,500 lb. and a tractive effort of 39,800 lb.

English Railway Shopmen's Demands

LONDON.

At a meeting of the local railway shops' committees connected with the Engineering and Shipbuilding Trades' Federation recently held at York, the following draft of a national program for the railway shops of Great Britain was formulated.

1. That all craftsmen be called upon at once to join their respective craft unions.
2. District rate of wages to all grades.
3. Consolidation of all war bonuses, including the 12½ per cent, into standard district rates.
4. A 44-hour working week.
5. Abolition of systematic overtime, local arrangements to be made for overtime in cases of emergency, breakdown, repairs of plant, etc., overtime rates to be not less than time and a half for time workers and rate and a half for piece workers.
6. A week's holiday with pay, and payment for all recognized statutory holidays.
7. Abolition of the age limit in the medical examination and a share in the management and control of railways.

British Labor to Participate in Railway Control

LONDON.

J. H. Thomas, the general secretary of the National Union of Railwaymen, who has been conducting negotiations with the British Government relating to railwaymen's wages, in a speech before railwaymen at Bristol on November 16, outlined the government's offer to the railwaymen regarding their participation in government control of the railways. In brief, the plan is that three union representatives will join the Railway Executive Committee with powers equal to those of the general managers on this committee; a joint board is to be formed composed of five general managers and five representatives of the unions to deal with conditions of service; a committee of 12 is to be formed composed of four representatives from the unions, four from the railway companies and four from the public with an independent chairman, which will consider questions on which the joint board fails to agree, and, further, local committees will be formed made up of an equal number of representatives from the management and the men to deal with local grievances.

Mr. Thomas made it clear that the negotiations relating to the participation in railway control were independent of the negotiations dealing with the standardization of wages. The latter is still being discussed. In the joint board three of the five union representatives will represent the National Union of Railwaymen and two the Associated Locomotive Engine Drivers and Firemen. This joint board will have plenary powers, but only in the sense that the men's side will be subject to their executive committee.

In commenting on the committee of twelve, representing the railwaymen, the railway companies and the public, Mr. Thomas said in regard to the four members representing the public, one will be a trade unionist not connected with the railways and another will be a representative of the great cooperative movement. Furthermore, he said: "We want you, however, clearly to understand that while they will be in a position to give recommendations and to advise and suggest, neither body will have the power to take away the right to strike so far as the men are concerned, but obviously we would not strike while a matter was being considered. That, in my judgment, is the first step towards some real machinery for dealing with working conditions."

In speaking of the three union representatives on the Railway Executive Committee, Mr. Thomas said, "I deny the possession of a monopoly of brains by the employing classes, whoever they are, and I have never hesitated to affirm that to general management the workers could contribute much." Two of the three labor members to join the Railway Executive Committee will come from the National Union of Railwaymen and the third from the Associated Locomotive Engine Drivers and Firemen.

In recommending the acceptance by the unions of the government's offer of share in control, Mr. Thomas said, that while this scheme will not render strikes impossible, it will, if properly worked in a fair and genuine spirit on both sides, do much to make trade unionism not only a means of improving men's condition, but also to smooth working on the railways of the country.

Equipment and Supplies

Cars Constructed in Railroad Shops in September

New cars were constructed in railroad shops during the month ended September 30 as follows:

Class of cars	Steel	Steel under-frame	Steel center sills	Wood	Total
Passenger—					
Sleeping
Parlor
Dining
Parlor observation
Dining observation
Passenger baggage
Passenger coach
Passenger and mail
Mail
Baggage and mail
Baggage
Express
Express and refrigerator
Horse express
Milk
Total passenger equipment
Freight—					
Stock	4	4
Hopper	7	7
Gondola
Flat	3	3
Coke rack	2	2
Work car	1	1
Miscellaneous freight cars	3	3
Caboose	22	...	...	1	23
Box	106	79	185
Refrigerator
Total freight	22	...	106	100	228
Grand total	22	...	106	100	228

Freight Cars

THE CHESAPEAKE & OHIO is in the market for 1,000 hopper car bodies.

THE INTERSTATE RAILROAD has ordered 510 55-ton hopper cars from the Pressed Steel Car Company.

THE NEW YORK CENTRAL is inquiring for 1,000 hopper car bodies for the Pittsburgh & Lake Erie.

THE U. S. STORES COMPANY, Salt Lake City, Utah, has ordered 11 box cars from the Mt. Vernon Car & Manufacturing Company, Mt. Vernon, Ill.

THE BRIAR HILL STEEL COMPANY, Youngstown, Ohio, has ordered 50 mine cars from the American Car & Foundry Company.

Passenger Cars

THE PENNSYLVANIA EQUIPMENT COMPANY, 1420 Chestnut street, Philadelphia, Pa., is in the market for six passenger coaches.

THE ST. LOUIS, BROWNVILLE & MEXICO has ordered 10 70-ft. coaches and 6 70-ft. baggage cars from the American Car & Foundry Company.

Signaling

THE CANADIAN NATIONAL RAILWAYS have awarded contracts to the Union Switch & Signal Company, Swissvale, Pa., for two half-interlocking plants at Fort William, Ont.

THE NEW YORK CENTRAL has ordered from the Federal Signal Company, Albany, N. Y., a 64-lever, style "A," mechanical interlocking machine to be installed at Warners, N. Y.

THE LEHIGH VALLEY has awarded a contract to the Federal Signal Company, Albany, N. Y., for an electric interlocking at Newark, N. J. The machine will be a 32-lever, Federal type 4, direct current.

Railway Financial News

BOSTON & MAINE.—See editorial elsewhere in this issue.

CANADIAN PACIFIC.—Sir John Eaton, of Toronto, has been elected a director to succeed Wilmot D. Matthews, deceased.

CHICAGO, PEORIA & ST. LOUIS.—The committee representing the general and refunding mortgage bondholders has adopted a resolution declaring that "unless Congressional enactments and other subsequent developments" should make the company's prospects more promising than they now appear, the bondholders should no longer subject themselves to the loss and risk of loss involved in continuing the operation of the road. The committee calls upon the Bankers Trust Company, trustee under the mortgage, to take immediate steps to foreclose the mortgage, with the object of reducing the property under the mortgage to cash, by sale, or scrapping, or otherwise. The resolutions declare further that, pending foreclosure, the receivers should not risk further losses by operating the property.

The Chicago, Peoria & St. Louis owns 234 miles of line in Illinois and operates a total of 255 miles, the main line extending from Pekin to Peoria. Interest on the \$2,850,000 general and refunding mortgage bonds has been in default about two years. It has \$2,000,000 other bonds and \$4,000,000 stock, or a total capitalization of about \$38,000 per mile of line owned. Receivers were appointed in July, 1914.

Of a small issue of equipment notes, the principal and interest due November 1, 1918, were paid by the Railroad Administration, which refused to provide the funds for the notes due November 1 last.

PERE MARQUETTE.—This company has filed a petition with the Public Utilities Commission of Illinois for an order authorizing the issue of \$1,568,000 additional 5 per cent gold bonds of Series "A."

PITTSBURGH, FT. WAYNE & CHICAGO.—This company has declared an extra dividend of \$5.75 a share, addition to the regular quarterly dividends, on the common and preferred stocks.

TEXAS & PACIFIC.—J. L. Lancaster and Charles L. Wallace have been appointed receivers, succeeding Pearl Wight, former sole receiver, who has resigned.

The Long Island Railroad reports that in the month of September 95.5 per cent of its passenger trains reached destination on time. The number of trains reported was 1,986 and the number on time was 1,897.

Railway Officers

Railroad Administration

Operating

J. A. Mercer has been appointed acting trainmaster of the Montana division of the Northern Pacific, relieving D. A. MacMillan, granted leave of absence, due to illness.

W. J. Jenkins, conductor of the Denver & Rio Grande, has been appointed trainmaster of the Salt Lake division at Soldier Summit, succeeding **M. J. Ruland**, who has been transferred to the Green River division with the same headquarters.

G. M. Lillis, locomotive engineer of the Denver & Rio Grande, has been appointed traveling engineer and trainmaster of the Salt Lake division, at Soldier Summit, Utah, succeeding **G. T. Bourne**, who has been transferred to the Green River division, with the same headquarters.

L. B. Allen, assistant general manager on the Chicago, Burlington & Quincy, with office at Chicago, has been promoted to general manager of the Lines East, with the same headquarters, succeeding **E. P. Bracken**, whose appointment as federal manager was announced in the *Railway Age* of October 10 (page 763).

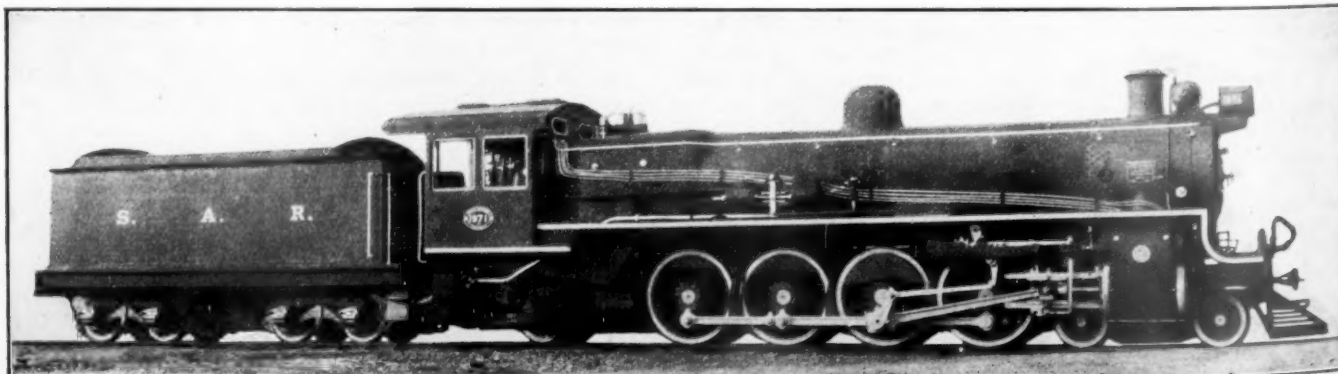
Corporate

Executive, Financial, Legal and Accounting

Pearl White, sole receiver of the Texas & Pacific, has resigned, and **J. L. Lancaster**, federal manager of that road, and **Charles L. Wallace**, assistant to the receiver, have been appointed co-receivers to succeed Mr. White. The appointment was made by the United States District Court for the Western District of Louisiana.

Special

Miss Daisy Oden, head of the information service in the general offices at Chicago of the Chicago, Burlington & Quincy, has been appointed supervisor for women service, with the same headquarters. Miss Oden will have charge of the welfare of all women in the employment of the road, looking after their comfort in the offices and other places in which they work. This is a new departure in railroad service, the outgrowth of the great increase in the number of women employed in all departments. Miss Oden was formerly passenger agent at Davenport, Rock Island and Moline for the Chicago, Burlington & Quincy.



Mountain Type Locomotive for the South African Railways

One of 20 recently ordered from the American Locomotive Company. The locomotive is superheated. It is of 3 ft. 6 in. gage; has 22 by 28 in. cylinders, 57 in. driving wheels; a total weight in working order of 194,000 lb.; a weight on drivers of 144,500 lb. and a tractive effort of 37,400. The American Locomotive Company is also building 20 other Mountain type locomotives for the South African Railways weighing 192,000 lb. with 22 by 26 in. cylinders and 48 in. driving wheels.

EDITORIAL

Railway Age

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Samuel Gompers in protesting before the Cummins Committee of the Senate against the strike clause of the Cummins bill, asserted many times that labor was not a commodity. In questioning Mr. Gompers, members of the committee not infrequently prefaced their remarks with a disclaimer of implying that labor

Labor a Commodity

was a commodity. The President in his recent message to Congress reiterated the statement that labor is not a commodity. Is not this a confusion of the words labor and laborer? Laborers are not a commodity, any more than capitalists or college professors or artists are commodities. On the other hand, what the capitalist possesses, capital; what the artist produces, pictures or statuary; what the professor writes, books or lectures, are commodities. Why then all this political horror of calling labor a commodity. The Century Dictionary defines the noun labor as "work done by human being or an animal; exertion of body or mind or both for the accomplishment of an end; effort made to attain useful results in distinction from exercise, for the sake of recreation or amusement." Labor in this sense would certainly seem to be a commodity. The importance in distinguishing between the laborer and that which he has to sell goes further, however, than a mere nice distinction between words. It has led to a confusion of thought about economic problems which is peculiarly insidious because of lending itself so easily to sentimentality. Trade unionism while taking as the slogan to use in its political discussions "labor is not a commodity," clearly distinguishes between the laborers and labor when it attempts to restrict the output of the individual laborer. Then labor becomes a commodity subject to the law of supply and demand, and the laborer who sells more labor than his most inefficient brother workmen, is regarded as cheapening the price of labor because he increases the supply of it. Every article used in commerce is composed of material and of labor. Why distinguish between the two component parts and call one a commodity but not the other? Labor is a commodity in the same sense that capital is a commodity.

"To the creation of our railroads, the public has contributed about \$700,000,000 of public moneys, and a land area about equal to that of Texas. . . . For

**A Mere
Nothing to Show
for It.**

this tremendous contribution of public property to railroads privately owned, the public now has nothing to show." The city of Chicago, of Cincinnati, of Denver, of Dallas, in fact every inland city in the United States, owes its existence as a great city to the privately owned railroads of this country. The \$700,000,000 mentioned above is but a small part of the increase in land values in Texas alone, directly attributable to the railroads created by private capital. What would wheat be worth a bushel in the Dakotas if it had to be hauled to the Great Lakes by wagon, or even by motor truck. For that matter, what would coal in West Virginia and Kentucky be worth were it not that hundreds of millions of dollars of private capital has been invested in building so perfect a transportation machine that a ton of coal can be hauled 300 miles for about 90 cents. Every commodity in commerce, has as

one of its attributes, place. The value that has been added by railroad transportation to commodities is incalculable. Copper in Arizona, pork in Indiana, cotton in Texas, coal in West Virginia, silver in Colorado, are all commodities, but the consumer must have these commodities at the point of consumption. The value which is added by transportation is at least as great as the value of the article itself. Transportation to the point of consumption is as necessary to create value as is the existence of the article to be consumed. The Virginian Railway was recently enough built so that the event of its opening is still fairly fresh in the memory of the citizens of Norfolk. Let any one ask them whether new values were created for the public by the building of the Virginian. There are people still alive who can remember the first railroad built into Denver, Colorado. It is safe to say that these people would testify to the fact that the railroads have added value to Colorado. For this contribution of \$700,000,000, about a tenth of one of the Liberty Loans—the public has to show the development of this United States as it is, a development inconceivable without the railroads. The statement quoted at the beginning of this paragraph was made by G. W. Anderson, for about a year a member of the Interstate Commerce Commission.

It is significant that the Public Ownership League recently met in Chicago and endorsed the Plumb plan with minor reservations. The incident is significant because it shows the ignorance and want of rational principle on which most of the agitation for government ownership has been and is based.

Of Negative and Destructive Character

Until the Plumb plan was put forward the advocates of government ownership also favored government management, and their arguments were roughly divisible into two classes. The first class of arguments consisted of attacks upon private management as being dishonest, selfish, inefficient and so on. The second class of arguments were directed to showing that government management would be greatly superior to private management because the managers would represent and be responsible to the public and would therefore strive to give it good service at low cost, rather than merely to make profits.

Under the Plumb plan the government would own the railroads, but it would not manage them. They would be managed by a board of directors, one-third of whose members would be appointed by the President of the United States and two-thirds by the official employees and the classified employees. All salaries and wages would be fixed by a board consisting exclusively of official employees and classified employees. In other words, the management would be one of the employees, by the employees and for the employees. There is not a single argument that has been used in favor of government management of railroads which can rationally be advanced in favor of the kind of management proposed in the Plumb plan, because the two kinds of management would be as different from each other as private management would be from either of them.

Why, then, have those who composed the Public Owner-